The Welding Engineer

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Founded by L. B. Mackenzie, 1916

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FEBRUARY, 1931 | VOL. 16, NO. 2

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The Buyer Has His Busy Moments

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The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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EDITORIAL

Standards for Schools

FOR a number of years one of the important problems facing the welding industry has been that of improving the quality of instruction in welding schools. A great deal of effective work has been done by associations and by individual manufacturers in the case of particular schools which, it is safe to say, has resulted in improving the average standard of training of welders. There has been lacking, however, something to serve the purpose of a measuring stick and consequently an incentive to the directors of schools to do the best possible work. It is reported that the American Welding Society plans to put a committee to work on the preparation of a set of standards which will outline the acceptable requirements of a welding school graduate; in other words, show what should be expected of a graduate of a welding school. There is no doubt of the value of such a set of standards. Each school will be allowed the widest latitude in the arrangements of its instruction program, but the test of the efficiency of each program would be based upon the knowledge and skill acquired by the students. The industry will certainly be able to profit by the work of the committee mentioned.

Not A Handicap But an Opportunity

APPARENTLY there is some thought in foundry circles that the whole objective of the welding industry is to put the foundries of the country out of business. Some of them have made a careful enough analysis of the situation to realize that this is by no means the case. Most foundries have for years depended upon welding processes to avoid heavy losses from imperfections in castings, and consequently they should be more or less familiar with the fundamentals of good welding practice. It is true that a good many of the current applications of welding tend to replace castings by fabricated units utilizing rolled steel. Some foundries are finding out that they are able to use the welding process to good advantage for the assembly of two or more small, simple castings into a complete unit which would be extremely difficult to cast as a single piece. Such foundries are not going to find their business falling off to any large degree, if at all. If they just keep on applying the principles of design, they will find constantly increasing opportunities to give better service to their customers and along with such service a better product at a more attractive price than ever before. Welding will not be a handicap to the progress of such foundries. On the contrary, it will be an opportunity for them to demonstrate to their customers a greater capacity for service and a spirit of progressiveness, which will have a healthy effect on the volume of orders. This is particularly true of steel foundries. It is doubtful if the iron foundries have made any progress with the idea of combining castings. This doesn't mean that it cannot be done. It probably will be done by some foundries which are energetic enough to find ways to turn this apparent enemy into a new friend.

A Tool for the Jobless

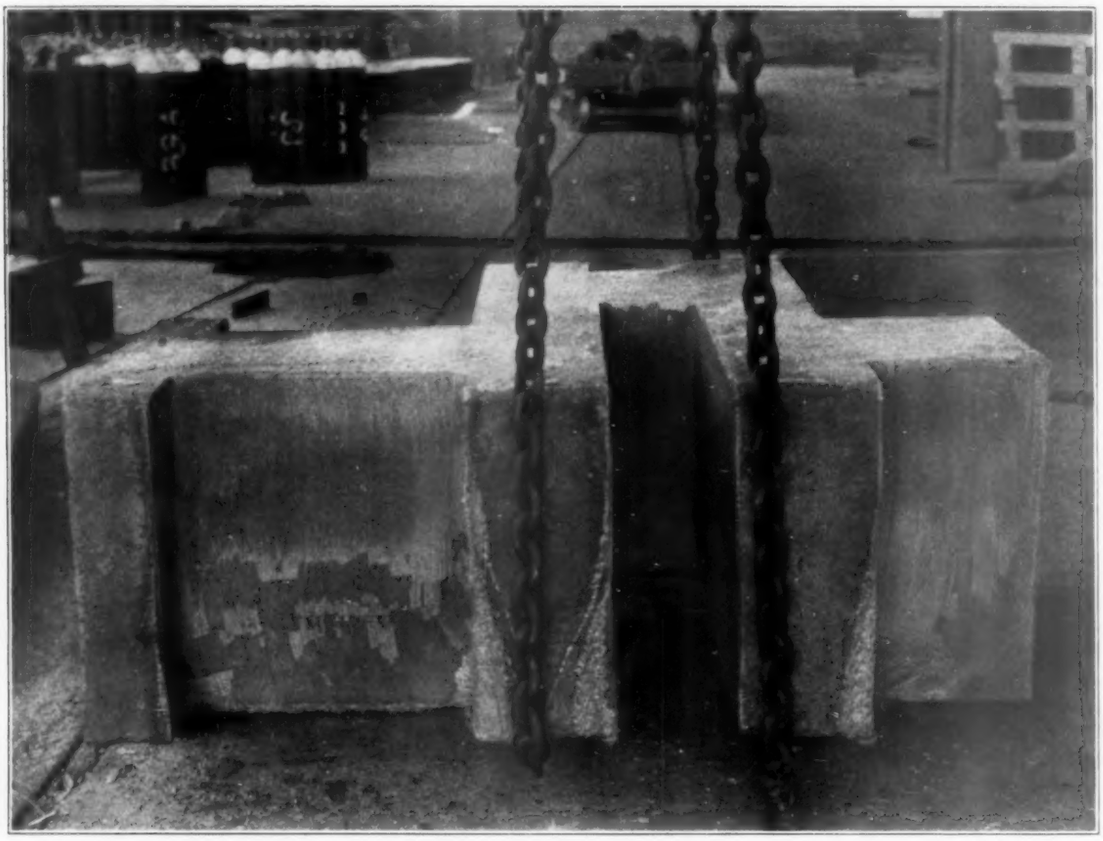
CUTTING torches are being used to dispose of abandoned automobiles along Illinois highways, these torches being wielded by heads of families who otherwise would be out of jobs. This is a part of the work instituted by Governor Emmerson's commission to employ jobless men at such jobs as will not conflict with public work regularly planned or under way. Other men are opening drainage ditches along highways and others are putting up drift fences at those points where deep snow drifts are likely to interfere with the movement of traffic. Governor Emmerson's commission is spending $5,000,000 in the relief of distressed families by employing the heads of families at such work as that described. Most of this amount has already been raised by subscriptions from business firms and individuals. An advantage of employing jobless men in work of this nature, aside from the ostensible purpose of unemployment relief, is that jobs of this kind unless done outside of the regular work of public bodies will probably never be done. As an example, the cutting up and carting away of abandoned automobiles will result in removing eye-sores from the public highways which, without such an emergency as we have today to urge on such a program, probably would have remained for many years to come.

Slowing Up Obsolescence

MANUFACTURERS of industrial equipment are giving a great deal of thought to the subject of obsolescence as a factor in creating markets for new equipment. How long, they ask, can any manufacturer afford to use old machinery when his competitors have installed machines of later design which will produce the same things at lower cost? He must certainly reach the point some day when his higher costs not only keep him from making progress, but also start a decline in his business. If this happens at a time when general business conditions are unfavorable, it presents a tough problem. There is possibly an economical solution by using the welders art to alter or rebuild present equipment so that it will be capable of greater production. Structural parts can be strengthened, under size parts can be enlarged, dimensions can be altered, small units can be assembled into a larger unit to work from a single source of power. Such alterations would be difficult only from a design standpoint as a rule, the welding itself being simple and easy of execution, and the redesigned equipment would serve to tide the user over the period of stress. The manufacturer of nearly any product knows that he is constantly in danger of seeing his equipment become obsolete, but a full knowledge of the welding processes and their possibilities may well serve to slow up the approach of obsolescence in a good many cases.

Progress in the Pressure Vessel Field

AT THE joint meeting of the A. W. S. and A. S. M. E. held at New York recently for discussing the proposed code to cover the welding of large dimension unfired pressure vessels there was shown a spirit of harmony and mutual understanding which should contribute materially to the progress of this important piece of work. Although the work under discussion comprises a very small percentage of the total number of tanks and containers now being fabricated, it is certain that by allowing such vessels to be welded, the way would be paved for further research toward perfecting methods and materials, which developments would undoubtedly find much usefulness in the fabrication of smaller welded tanks and containers. In the long run, therefore, this code is bound to have some effect on the makers of small tanks. The present problem, however, is to develop the new code in such a manner as to guarantee safety to a reasonable extent, and at the same time avoid unnecessary provisions which would rob welded construction of its recognized economy.



The above cut was executed with a Victor Machine Cutting Torch at the Mare Island Navy Yard, Mare Island, Calif.

Size of Billet.....25″x50″x15′
Material.....Class Bc—.60 Carbon Steel
Weight of Billet.....33 Tons

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Welding a Skyscraper

Details of Design, Erection Methods and Inspection Procedure Followed in Building the 19-Story Welded Building in Dallas, Texas

By F. P. McKibben

In Two Parts—Part One

Why Weld?

NOT a desire to surpass existing records for tall welded buildings, but noise abatement prompted the Dallas Power and Light Company to weld the steel frame of its nineteen-story office building erected recently in Dallas, Texas. That the unfolding of another of those perfectly beautiful works of art, for the creation of which the imaginative genius of American engineers and architects has become so deservedly famous, was accomplished without adding appreciably to the city's din is highly commendable. That the erection of this structure surpassed the world's record for the tallest welded building is purely incidental.

The knowledge that during the month of May, 1930, in the Borough of Manhattan, 789 buildings were built or altered gives one a measuring unit by which to gauge the enormity of building operations in progress in the metropolis in recent years. And what is true of New York is likewise applicable to the majority of our cities, the difference being one of magnitude only. What is the meaning of all this activity? Is it not a result of man's endless effort to improve the conditions under which he lives and works?

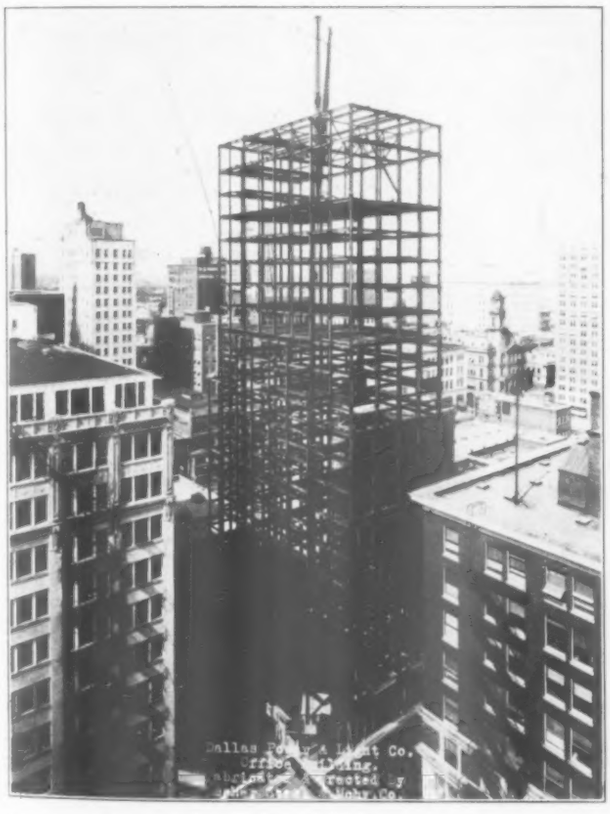


Fig. 2.—Dallas Power and Light Company's Shop and Field Welded Nineteen-Story Office Building.

Height, 245 ft. 8 in. from basement floor. Steel tonnage, 1,215. Two welded trusses for supporting the nineteenth floor and the roof may be seen.

Noise An Enemy of Society

But the very demand which results in these wonderful modern structures, also necessitates their being placed close-

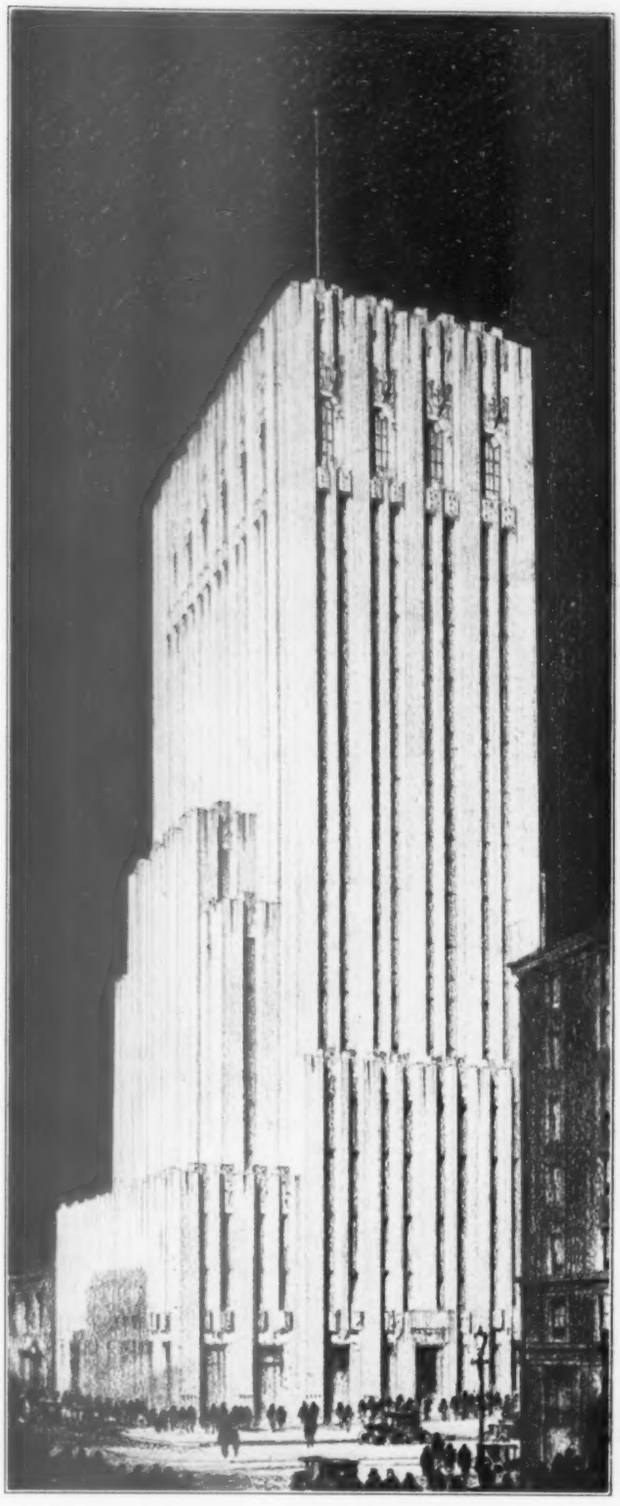


Fig. 1.—The World's Tallest Welded Building, Dallas, Texas.
From the Architect's Drawing.

ly together, and in satisfying one need others are created, among which is noise abatement. Herbert Spencer said that "you might gauge a man's intellectual capacity by the degree of his intolerance of unnecessary noises." Thomas Carlyle caused to be made a sound-proof room in which to work. All this merely goes to show that the question of noise abatement recently brought to the fore by New York is an old problem—so old even, that the ancient Greeks wrestled with it. But mirabile dictu! None other than Wall Street now recognizes that to produce a great din demands at least an apology. An official of a company constructing a building

at Broadway and Wall Street sent engraved apologies to his neighbors carrying these words; "May we hope that you will bear with us as patiently as possible during the unavoidable noisy weeks that lie ahead while the steel frame of our headquarters building is going up? To us, naturally, the sound of riveting means gratifying progress toward completion of the building. To our neighbors it means a most unwelcome distraction."

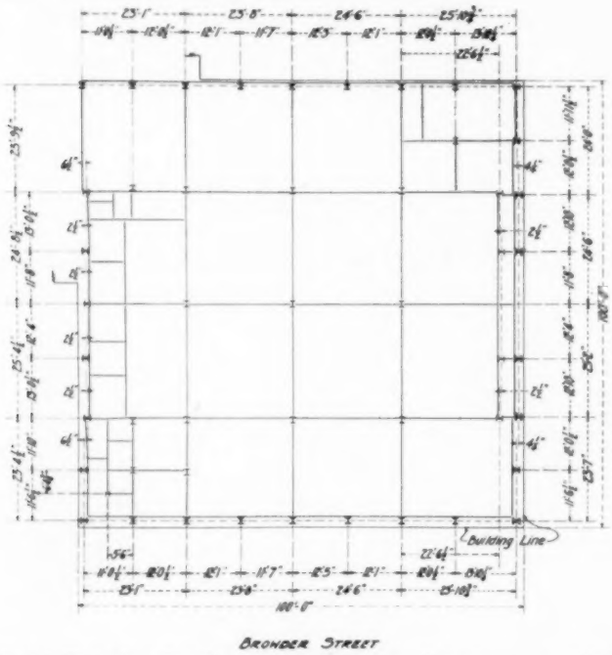


Fig. 3.—First Floor Framing Plan Showing General Arrangement of Main Beams and Columns.

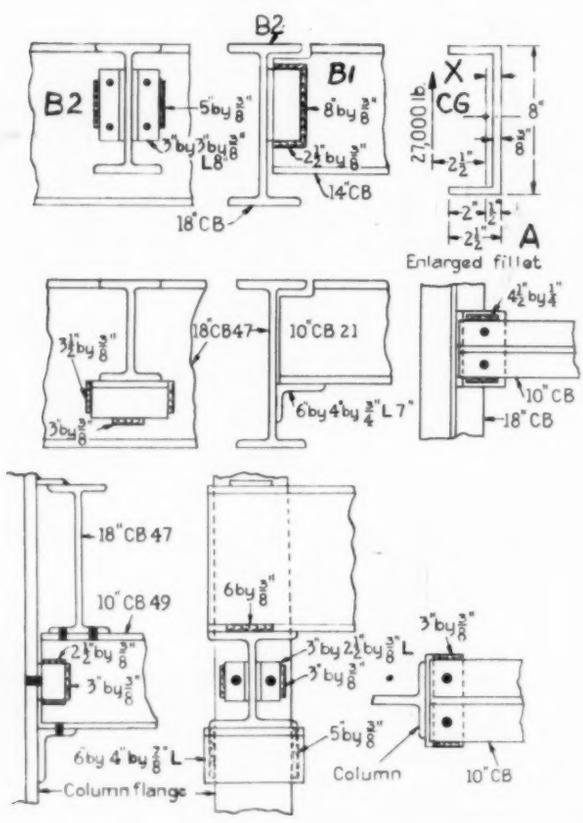


Fig. 4.—Typical Connections of Small Beams to Larger Beams and to Columns.

Connecting angles are shop welded to small beam and field welded to larger beam or to column. Shelf angles are shop welded to larger beam or to column.

But what, under prevailing conditions in New York, could be done about it? Nothing. Riveting is a recognized and reliable means of erecting steel building frames; the industry is equipped for it; the building code of New York at present demands it; engineers, architects and builders understand it. Nevertheless, this noise problem will not be satisfied by excuses. It must and will be given attention.

The New York City Merchants' Association's Committee on Building Laws, through its sub-committee on Minimum Loads and Structural Steel and Iron, recently investigated the possibilities of fusion welding in steel building construction; and, as a result, the Committee's report to the Merchants' Association, concurred in by the Committee on Building Code and Construction of the Noise Abatement Commission, contained the following recommendations, which, if adopted by the municipality, will legalize welding:

"Welding. Fusion welding may be substituted for, or used in combination with riveting or bolting to connect or assemble the component parts of steel beams, girders, lintels, trusses, columns, and other structural steel used in building construction if done under rigid inspection and specifications, in accordance with the rules of the Board."

"Field Riveted, Bolted and Welded Connections. In all tier structures less than 125 feet in height, in which the height is less than 2½ times the minimum horizontal dimension, all column splices and field connections may be bolted.

"In all structures over 125 feet in height, and in structures of a special character, connections of beams and girders within 3 feet of columns shall be riveted or welded. Column splices in structures 200 feet or more in height shall be riveted or welded. Column splices in tier structures less than 200 feet in height may be bolted. All other connections may be bolted, except that, in all structures, the supports for running machinery or other moving loads, shall be riveted or welded."

Further evidence that welding is recognized as having great possibilities lies in the foreword of the report of the

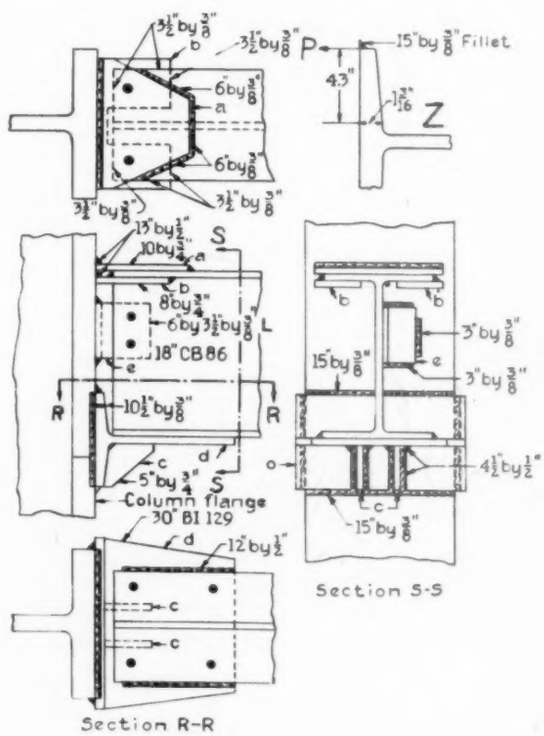


Fig. 5.—Typical Connection of Beam to Flange of Interior Column.

The sequence of construction follows: Shop—After welding stiffener plates c to seat d, the seat was welded to column flange; the side connecting angle lug e welded to column flange; flange plate b welded to top flange of beam. Field—Beam bolted to lug e and seat d; beam welded to seat d; flange plate b welded to column; flange plate a placed and welded to beam and column. See also Fig. 6.

subcommittee on Minimum Loads and Structural Steel and Iron which reads as follows:

"Welding has been developed to a high degree in the shop fabrication of many items, much more so than for structural steel. It is gradually, however, being extended into that field and must soon take its place as supplementing the present widespread use of riveting wherever its characteristics make it the logical method. At the present moment, however, its use must be surrounded by certain well recognized safeguards to prevent incompetent and irresponsible individuals from attempting a more widespread use of the method than the available supply of competent designers, workmen and inspectors justify. The recommendations of the American Welding Society have been incorporated in our draft."

Proximity to Important Buildings in Congested Business District

As this latest giant of the welded family extends along Browder Street from Jackson to Commerce Street in the business section of Dallas, the necessity for welding becomes apparent when one realizes that only a narrow street separates it from the Baker Hotel, the Federal Reserve Bank, the telephone company's building; and that the Adolphus Hotel, Magnolia Building and other important structures are close neighbors. Field welding was highly desirable for use at this site. Moreover, the use of electric hoists resulted in a further elimination of noise and dirt, and added much to the comfort of occupants of nearby buildings.

This nineteen-story structure, followed or developed simultaneously with the welded office buildings of the Edison Electric Illuminating Company in Boston, of the DuPont Company in Wilmington and of the Southern California Edison Company in Los Angeles, each of which is fourteen stories. Various other large welded buildings were erected during the same period.

As the City of Dallas had previously adopted a new building code including provisions for welding steel building frames, none other than a usual building permit was necessary in this instance. In some cities, Boston for example, where welding has not yet been incorporated in the codes, special permits have been granted, thus enabling the use of welding. But Dallas, with a population of 260,000 in 1930, like several other southern and southwestern cities such as Houston (population 289,600) and New Orleans (population nearly half a million), has recognized the advantages of welding and changed its code accordingly. The three cities named are among the largest of ninety-three to legalize welding. New Orleans is indeed the most populous of all places to have taken this course.

Main Features of the Building

The Dallas building will be used as headquarters of the Dallas Power and Light Company and consists of two parts, the greater of which is 19 stories high, being 245 feet 8 in. from basement floor to the highest point. The nineteen-story portion measures in plan 100 ft. by 100 ft. to the fourth floor; 77 ft. 4 in. by 100 ft. to the sixth floor; 77 ft. 4 in. by 96 ft. 6 in. to the twelfth floor; and 54 ft. by 96 ft. 4 in. to the roof. Main set-backs exist at the fourth and twelfth floors and smaller ones at the four corners of the main structure.

As excellent foundations were available, the columns were placed on rolled steel slabs distributing the loads to small concrete footings and from these to rock.

The seventeenth story, 22 ft. in depth, with a mezzanine or eighteenth floor across its rear, is a large room really extending through two stories. This requires the use of two trusses, spanning the 54-foot width of the building, to support the nineteenth floor and the roof. These welded trusses have depths practically equal to that of the nineteenth story.

The floor system consists of metal tile reinforced concrete construction, with bays approximately 24 ft. to 25 ft. square, supported on the two sides by steel beams extending from column to column; with no intermediate filling-in beams except in the vicinity of stairways, elevators and other similar places.

The main steel skeleton consists essentially of rolled columns (a few with added flange plates), main beams running from column to column in one direction, with tie beams in the other direction, seven welded trusses, and three shop-riveted field-welded plate girders; the whole having a tonnage of 1,215 of which 1,170 are in the main structure, and 45 tons in a two-story extension.

The lower portion of the building is approximately 62 ft. by 99 ft. in plan, two stories in height with ceiling and roof supported on five welded Warren trusses having spans of 61 ft. 6 in.

Fig. 6.—Typical Connection of Beam to Flange of Interior Column. See also Fig. 5.

Specifications Controlling Welded Construction

Specifications controlling the design and construction of welded steel were those prepared by the writer and first published in *Engineering News-Record*, March 14, 1929, of which the following is a resumé of principal features:

Structural steel and electrodes: Structural steel shall be specified by A. S. T. M. Serial No. A9 as amended to date; chemical composition of electrodes shall conform to these limits, carbon 0.13% to 0.18%, manganese 0.40 to 0.60% phosphorus not over 0.045%, sulphur not over 0.045%, silicon not over 0.06%.

Permissible unit stresses: for dead and live loads; shear on end or side fillets 11,300 lb. sq. in., tension 13,000 lb. sq. in., compression 15,000 lb. sq. in.; for dead, live and wind loads, above may be increased 33⅓%; to the calculated length of each fillet, ½" shall be added for the crater.

Current values: for $\frac{3}{32}$" or $\frac{1}{8}$" diameter electrodes, 175 to 200 amperes.

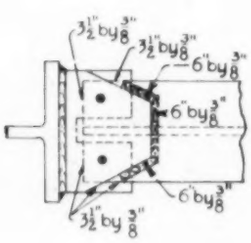
Workmanship: surfaces to be welded shall be cleaned of loose scale, rust, paint or other foreign matter; steel parts to be welded to be in close contact; welders shall

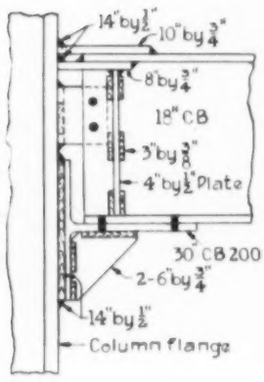
show competency by qualifying tests; bolts shall be used to connect properly all members during erection.

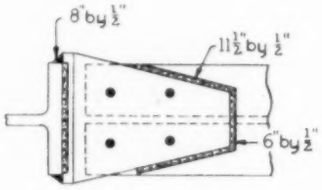
Typical Structural Details

In a building of this base and height the wind stresses are comparatively large and the amount of welding at connections of beams to columns to transmit the moments are correspondingly great. This should be born in mind while studying the accompanying details of welded joints, exhibited herewith in Figures 4 to 10 inclusive, representing three types of joints underlying the design of this structure, namely, beams to beams, beams to column flanges, column splices.

In general the connection of one beam to the web of another was accomplished by two connecting angles, Figure 4; but some were made by resting the smaller beam upon, and field welding it to a shelf angle shop welded to the supporting beam. Let us consider the strength of that type at A, Figure 4, where the connection is made by two 3x3x⅜" connecting angles shop welded to beam B1 and field welded to B2. The vertical load to be transferred is 27,000 lb.; ⅜" fillets at 11,300 lb. per sq. in. of throat section equivalent to 3,000 lb. per lin. in.; ½" allowance for crater.







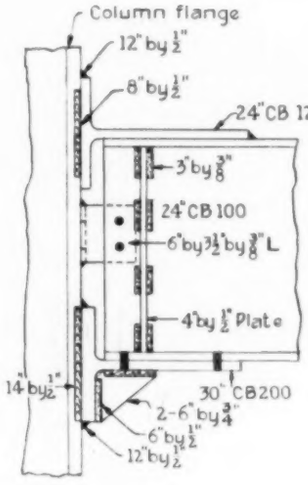


Fig. 7.—Connection of 18-in. Beam to Column Flange.
Web of beam is stiffened with one 4"x½" plate, intermittently welded to beam web by 3"x⅜" fillets spaced 6" apart. This connection carried a heavy derrick load during erection.

Fig. 8.—Connection of 24-in. CB 100 to Column Flange.
Wind bracing bracket of "split" I beam used on each flange. Web of beam stiffened by one 4"x½" plate intermittently welded.

$$\text{Field welding on each angle} = ½" + ½\left(\frac{27000}{3000}\right) = 5" \text{ as shown.}$$

Now using the fillets shown at A compute the maximum unit stress due to vertical load of 27,000 and its bending moment on the angles. First find center of gravity of shop fillet, represented by distance X at A in Figure 4.

$$13X = 2(2½)1¼$$
$$X = ½"$$

Assuming that the intensity of stress on the fillet is proportional to distance from center of gravity of the fillet and that the bending is carried by the upper and lower horizontal fillets only; and calling w the maximum intensity per linear inch due to bending,

$$2½(w)4(2) = \frac{27000(2½)}{2}$$

w = 1690 lb. per lin. in., acting horizontally.

$$\text{The direct vertical shear} = \frac{27000}{26} = 1040 \text{ lb. per lin. in.}$$

acting vertically.

$$\text{Resultant shear} = \sqrt{(1690)^2 + (1040)^2} = 1980 \text{ lb. per lin. in.}$$

The above approximate method is not exact but is accurate enough in this case. Instead of finding the center of gravity as shown, it is sufficient and better to use the width of angle leg as the lever arm in computing moment.

Let us now investigate the strength of the "wind bracing" connection of Figure 5, showing a typical connection of an 18" OB 86 with the flange of a column. Moment at end of beam 183,000 ft. lb.; wind shear 15,000 lb.; live plus dead shear 44,000 lb.

The floor load of 44,000 lb. is transferred from beam to wind bracket by two 5" by ¾" stiffeners c, Figure 5, with

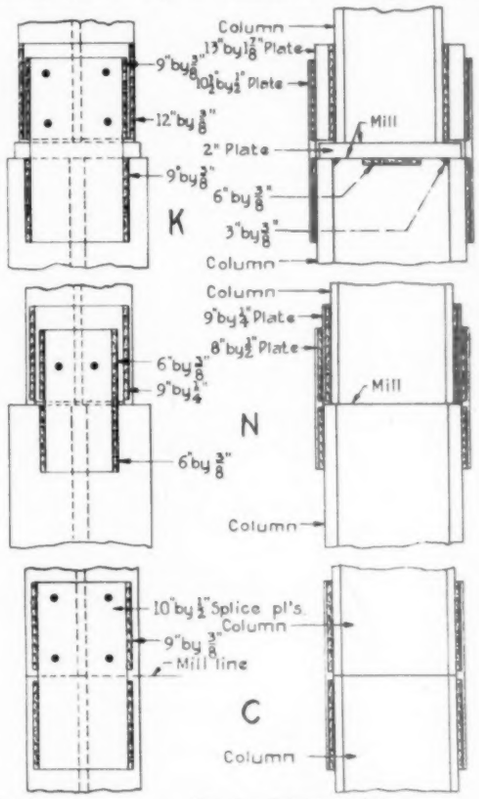


Fig. 9.—Column Splices.
Type K with horizontal plate intervening between upper and lower columns. Type N, one splice plate on each flange; with two fillers due to unequal widths of the two column sections; Type C, one splice only on each flange, for use where upper and lower columns have the same width; no fillers necessary.

4 (4½ —½) = 16 in. of ½" fillet; 44,000 ÷ 16 =2,750 lb. per lin. in., against 4,000 allowable; hence ample.

The stress in each flange due to moment is 183,000 ÷ 1.5 = 122,000 lb. This is transmitted from upper flange by 34½ in. of ⅜" fillet at 122,000 ÷ 34½ = 3,540 lb. per lin. in., against a permissible 3,000 + 33⅓% of 3,000 =4,000 lbs. per lin. in. for wind; hence ample; then from the two upper flange plates into the column by 2(13 — ½) = 25 lin. in. of ½" fillet at 122,000 ÷ 25 = 4,880 lb. per lin. in., against 4,000 + 33⅓% of 4,000 = 5,330 lb. per lin. in. for wind; hence ample.

This 122,000 lbs. stress is transferred from bottom flange of beam into wind bracket by 2(12 — ½) = 23 lineal inches of ½ inch fillet at 122,000 ÷ 23 = 5,300 pounds

per lineal inch, against 5,330 allowable; hence ample.

From the wind bracket into the column the 122,000 lb. bottom flange stress is quite sufficiently provided for when in compression. When this stress is tension a combined vertical force of live, dead and wind shears of 29,000 lb. acting downward and the 122,000 lb. tension are acting simultaneously, and should be investigated as follows: First find stress P which can be transmitted at upper 15"x⅜" fillet, see Z Fig. 5, the flange of wind bracket acting as a cantilever with force P at upper edge with a lever arm of 4.3" and a sectional area in bending of 18" by $1\frac{3}{16}$"; 4.3P = 24,000 (4.23), P = 24,000 lb. approx., or 1,600 lb. per lin. in. of fillet; 24,000 lb. sq. in. is permissible unit bending stress and 4.23 is the section modulus of the 18" by $1\frac{3}{16}$" section. Second, deduct the force of 24,000 lb. from the total flange stress, leaving 122,000 — 24,000 = 98,000 lb. to be carried by say 27" of ⅜" fillet, or 98,000 ÷ 27 = 3,630 lb. per lin. in. which acts horizontally on the fillet. Third, the vertical load of 29,000 lb. is distributed over 50 lin. in. of ⅜" fillet of wind bracket, or 29,000 ÷ 50 = 580 lb. per lin. in., acting vertically. Fourth, the resultant of 3,630 horizontal with 580 vertical gives 3,680 lb. per lin. in. against 4,000 allowable on ⅜" fillets under combined live, dead and wind; hence ample.

This design for the wind connection obviates all overhead welding, but increases greatly the amount of field welding. The wind bracket was shop welded to the column, a feature satisfactory in this case because the columns were hauled in trucks directly from the fabricating plant in Dallas to the building site, thus eliminating much handling that in other cases would be necessary. It will be noticed, Figure 5, that top flange plate **b** is slotted around the beam web; and that the beam is merely bolted not welded to lug angle **e**.

Trusses Over Large Room of Eighteenth Story

Two shop and field welded trusses, Figure 11, spanning the 54-ft. width of the tower above the eighteenth story, support the ceiling of that story, the nineteenth floor and the roof. The location of these trusses is shown in upper part of Figure 2.

These two trusses 12 ft. 10 in. deep, 50 ft. 9 in. **c** to **c** of supporting columns, are of the Pratt type, with chord and web members made of angles or channels. The peculiar arrangement of web members in the central panel permits a passageway through the partition in which the truss is located. And this partition necessitated the use of a very thin truss, with only sufficient space between the parts composing any one chord or web member to admit gusset plates. Were more width available for the truss, gusset plates could have been eliminated with a resulting saving of approximately 50 per cent of welding at connections of web and chord members. In truss design the only function of gusset plates is to connect the diagonal and vertical web members to the chords, and as web members have to be welded to the gussets, which in turn are welded to the chords, much welding is wasted. The designer should endeavor to eliminate gussets whenever possible to do so.

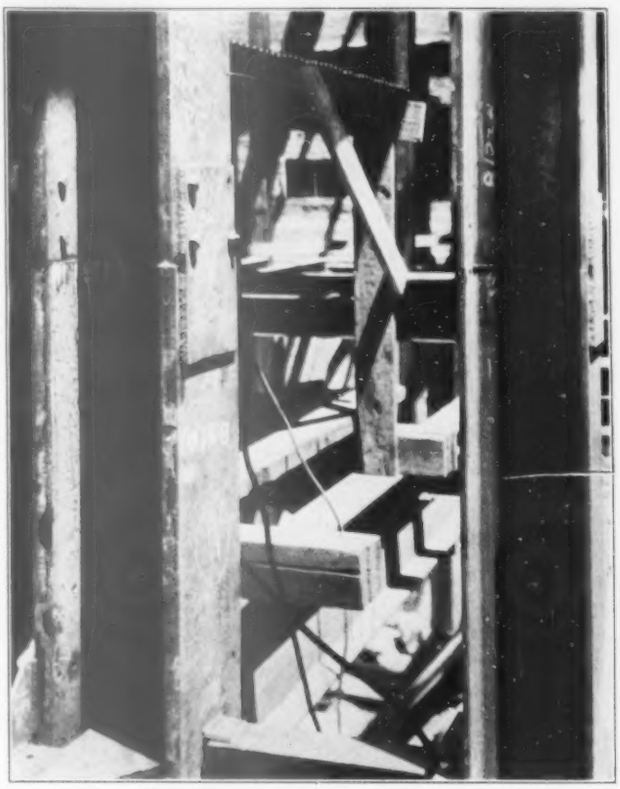


Fig. 10.—Welded Column Splices.
Splice plates are shop welded to the lower column, field bolted to upper column, then field welded to upper column. The filler plate is visible under the splice plate of the upper column.

(To be continued)

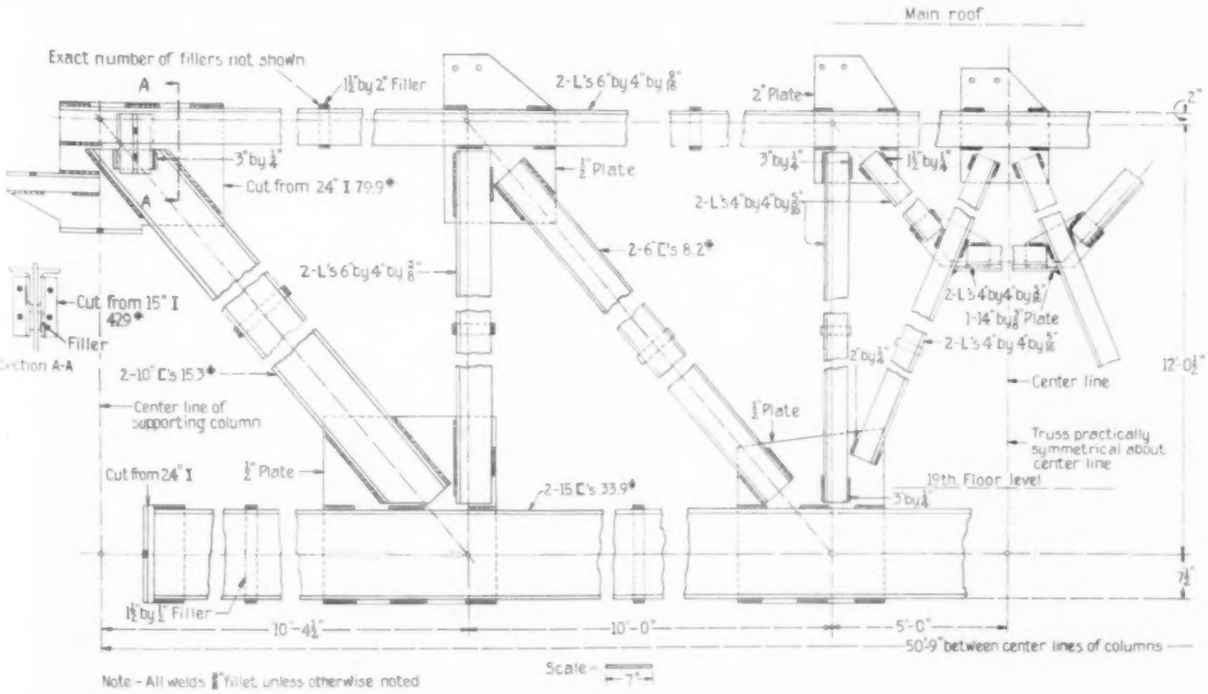


Fig. 11.—Shop and Field Welded Trusses Over Eighteenth Story.

Hints on Reclamation Welding

Heavy Iron Castings—Avoiding Hard Spots—Pulley Wheels — Bronze Castings — Building Up Worn Bronze Gears

By Fred A. Cosgro

WHEN repairing cast iron, the welder should bear in mind that while in some cases a hard weld is acceptable, the general rule is that it is desirable to finish with a soft weld free from hard spots. These develop when a welded piece of cast iron is cooled rapidly or air chilled. Under these conditions the carbon in the casting does not have time to separate from the iron in graphitic form but is held in solution and frozen, producing iron carbide. It is largely to avoid hard spots and contraction fractures that the usual recommendation for good practice is to preheat and anneal, using charcoal, natural gas or any convenient fuel, and slowing up the cooling by putting it in lime or molders' sand. In many cases, a weld which has been reheated and cooled slowly in lime has cracked afterwards. This is due to improper allowance for expansion. If this allowance is not correctly made, the shrinkage will always take place. The welder can test a casting after it is cooled by tapping the weld with a light hammer. If there are any locked up stresses, this will usually result in a fracture. Another thing that cast iron welders find when their welds fail is large blow-holes. These can be accounted for by failure to get the casting hot enough when welding.

Although the usual requirement for soft welds will be mainly considered in this discussion, it may be worthwhile to note that a glassy hardness can be secured by air chilling or by using table salt as a flux. It should be noted also that sulphur will induce brittleness and that powdered silicon will make a good, soft, easily machinable weld.

As an example of a cast iron repair which leads to worthwhile savings, take the large cast iron conical ball mill box as shown in Figure 1. These are used in all copper mining ball mills. Note that the discoloration at the end shows where it was preheated in a coal and coke forge. Each end of this casting was built up to replace metal which had been worn away and new holes were drilled after the welding was finished. The job shown required the addition of 50 lbs. of cast iron welding rod. A tin template was used to check the dimensions when new metal was added, and the added metal was smoothed up with an old file at the finish, and the job was allowed to cool down in the fire. Twenty-four of these castings were reclaimed from the scrap pile for a single company. On such heavy castings we speeded up the work by arranging four welding rods as shown in Figure 6. One of these serves as a handle for holding the other three together. Three rods arranged in this way will melt faster than a single rod having the same cross-section.

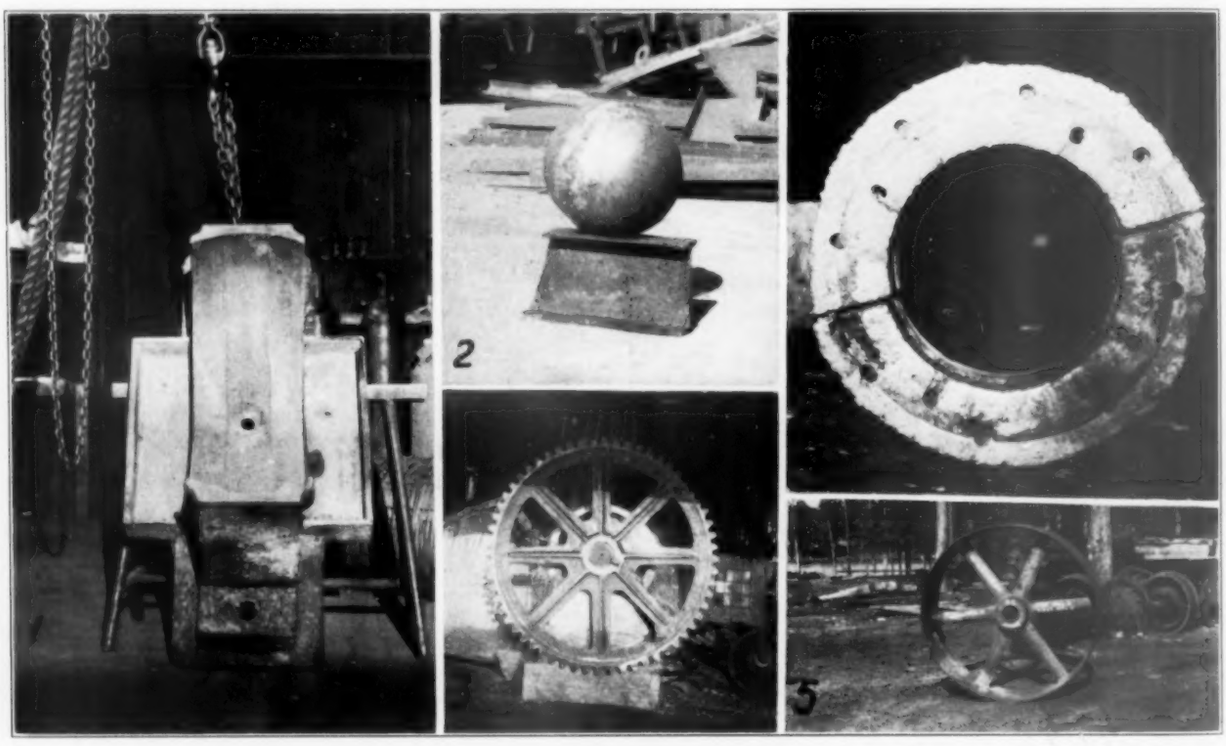


Fig. 1.—Cast Iron Conical Ball Mill Box. Fig. 2.—Welded Copper Sphere. Fig. 3.—Bronze Worm Gear Built up with Manganese Bronze. Fig. 4.—Bronze Crusher Nut. Fig. 5.—Typical Pulley Job.

The cast iron pulley wheel shown in Figure 5 is 40 inches in diameter and had one spoke broken. This is a case where it was desirable to avoid preheating the entire wheel. Therefore, sectional preheating was used. Preheating a large wheel like this makes the welding job extremely uncomfortable. Also, when the whole wheel is preheated, the job must be watched very carefully or stresses will be set up in the spokes around the hub which is a thicker section.

Instead of having a single break, suppose we had a six-spoke pulley wheel with all spokes broken at both hub and rim, leaving twelve welds to be made, as shown in Figure 7. A good procedure would be to first preheat the heavy

hub and make the six welds to the hub; then allow the job to cool. Then preheat the rim only and make the six welds at the rim. If it was preferred to follow the practice of preheating the entire job, the welder would probably find when it cooled off that the hub was warped out of alignment. The natural impulse is then to scrap it or cut it out and reweld; but this may not be necessary. Under these circumstances, we have found that by rigging up an iron block or by putting the wheel on a slotted face plate, placing a bar of iron across the hub with a bolt extending through the hub, then using two or three torches with large tips to heat the rim, we tighten the bolt slowly, then reheat and continue until the original alignment is obtained.

Figure 7 is a sketch of a badly broken pulley wheel which we had to repair in our shop. I center punched a mark on each side of each break and preheated between opposite spokes until I had a clearance of $\frac{3}{32}$". For convenience, I used a trammel made of a piece of high carbon welding rod.

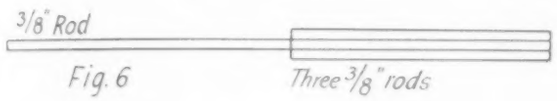


Fig. 6

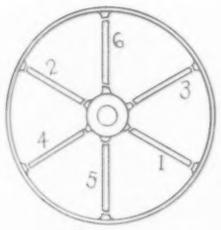


Fig. 7

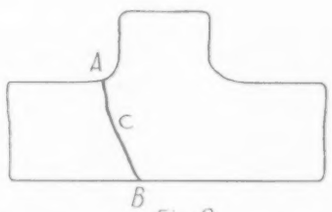


Fig. 8

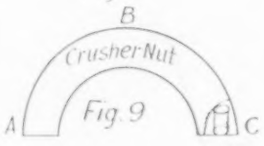
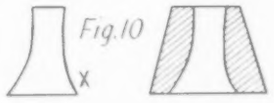


Fig. 9



After the job was complete, I heated the entire wheel and allowed it to cool slowly. When following this procedure, it is necessary to keep the heat as even as possible in order to avoid flat spots in the rim. It is also necessary to block up the hub so that it will not sag. In the case of small pulleys with the rim worn thin or a piece of it broken out and lost, the best procedure often is to machine a piece of large pipe to slip over the rim and bronze weld it to the old rim; then the outside can be machined and smoothed down for the belt.

Another type of cast iron repair is sketched in Figure 8 which indicates roughly a break in the cast iron stand. If we start at A and weld to B without first spacing it at B, the metal ahead of the torch would be expanding and the metal behind would be contracting, even if preheated to a cherry red. There might, therefore, be stresses left in it so that the weld could easily be broken by dropping a heavy weight on it afterward. This could be prevented by spacing at B about $\frac{3}{64}$" per foot of weld. An equally good procedure in this case would be to start from C and weld both ways. In case the casting is a thick one use plenty of heat and make sure of making a solid weld all the way through. In other words, "dig in" on it.

An unusual welding job is the copper ball shown in Figure 2. This was formed in two sections preheated in a charcoal fire and then welded. In welding a sphere like this, care must always be taken to leave a vent hole. Otherwise it will act like a bomb at the finish. The thinner the metal, the more dangerous it is.

As an example of a bronze repair, the large bronze crusher nut shown in Figure 4 will be described. These are used in crushers in copper mining work. They have threads on the outside, and when the threads wear down they must be machined off and built up. We first do some preheating. For our preheating fire we break up lump coke and mix with coal. This mixture holds a more even heat than the lump coke. When the parts are ready they are built up while still in the fire, using a manganese bronze filler rod. The welding time can be reduced by using two or three $\frac{3}{8}$" rods together.

Referring to Figure 9, the welding is started at A, carried to B, then started at C and welded up to B. We always arrange when possible to work vertically on bronze. It is faster and makes a better job with less danger of slag inclusions, laminations and pockets. It will be noted in Figure 9 that there is a large hole at C. These get out of round and have to be filled up and redrilled. To do a successful job, it is necessary to preheat almost to the melting point.

In one plant sixteen of these crusher nuts were built up using a total of 1,600 pounds of bronze rod. When working on bronze, it is always a good plan to drink sweet milk before starting and to drink some milk occasionally as you go along. If an electric fan is available, this should be set close to the work to draw away the fumes.

I have found that bronze and brass jobs can be improved by hammering at about 1,000 degrees Fahrenheit. If you have a flat casting or one that has a machined surface, try laying it on a hot plate of $\frac{3}{4}$" or 1" thickness. The most important procedure in bronze welding is never to allow the white inner cone of the flame to touch the metal.

The job illustrated in Figure 3 is a large bronze worm gear six feet in diameter, costing nearly a thousand dollars. The teeth of this gear become worn, and our standard practice is to build them up with manganese bronze. No preheating is necessary. Line the gear up in a bearing so that it will turn easily, and use a tin template to get the correct shape. Figure 10 shows the shape before and after welding. If the weld is started at the point X in Figure 10, the heat will be carried to the top of the tooth. The structure can be improved by hammering at about 1,000 degrees. It is not necessary to anneal. The gear shown in the illustration had fifteen teeth which required building up, and also a bad break in the rim. This break in the rim was chipped out from both sides and forced apart $\frac{5}{8}$" with steel wedges before welding, and we used bar iron straps to keep it in alignment. We preheated to a red heat and welded one side; then reheated and welded the other side, keeping the gear in an upright position. The total cost of reclaiming this gear was $280, and we used 190 lbs. of manganese bronze on the job.

Where heavy equipment is being used for such rough service as we encounter in mining, parts are constantly being broken or worn out. It requires skillful work and careful attention to procedure to reclaim them without spoiling the entire piece but the savings made are sometimes enormous. This is illustrated in some of the figures given above.

EWERTZ DESCRIBES ALL STEEL HOUSE BUILDING

E. H. Ewertz, well-known consulting welding engineer, New York City, gave a talk on welding in the construction of a home before members of the Men's Brotherhood of Epworth M. E. Church, of which he is president of the Board of Trustees, on the occasion of their annual dinner, which was held on January 16th. Using lantern slides to illustrate his talk, Mr. Ewertz cited the many uses welding plays in the modern home. He mentioned welded steel furniture,

steel casement windows, welded piping for heating systems, all-welded steel heating boilers and hot water heaters, cooking utensils, plumbing fixtures, garden implements, etc. He pointed out that the natural consequence of the usefulness of welding of the many details that make up the home has led to the design of homes having all welded steel frameworks. He described in detail the method of building such a home. This method is applicable to homes of stucco, veneer brick, stone or combinations of these. Cement may be used as a base for the floors or a wood floor may be laid, roofs having porous cement or similar material as a base and can be furnished with any of the present day roof coverings. He emphasized the fact that the cost of labor in the construction would be materially reduced and that the building time would be considerably less.

TENSILE TESTS DEMONSTRATED AT AMERICAN WELDING SOCIETY MEETING IN CHICAGO

At the January meeting of the American Welding Society, Chicago Section, which was held on Friday evening, January 9th, the first part of the program was a paper on the subject of "Fabricating Sheet Metal Products by Arc Welding." This paper was prepared by Mr. E. P. Bestler, Superintendent of the Sheet Metal Department of Raymond Brothers Impact Pulverizer Company, Chicago, and was illustrated by lantern slides. It showed how the production costs of many difficult sheet metal assemblies can be reduced by welding. Another interesting point brought out in the paper was that in shops where there is a considerable volume of production welding, it makes for greater efficiency to have one crew of men trained to assemble the work while another crew devotes all of its time to the actual welding.

The second part of the program of the evening was directed by Mr. Ernest Lunn, Consulting Engineer for the Welding Engineering & Research Corporation. In the December meeting, a welded tank had been inspected by means of the stethoscope, the electro-magnet and the X-ray. This welded tank had four different types of welds included in two longitudinal seams. Magnetographs made by means of apparatus furnished by the Westinghouse Electric & Mfg. Company Research Laboratories showed distinct differences in the qualities of the four welds. These differences were also shown very clearly in radiographs which were made by the General Electric X-Ray Corporation, of Chicago. The accompanying illustration shows radiographs of typical sections of each of the four welds. To make these illustrations a little clearer, it should be noted that the lighter portions of these pictures are the areas of greatest density, the dark spots indicating gas pockets or slag inclusions.

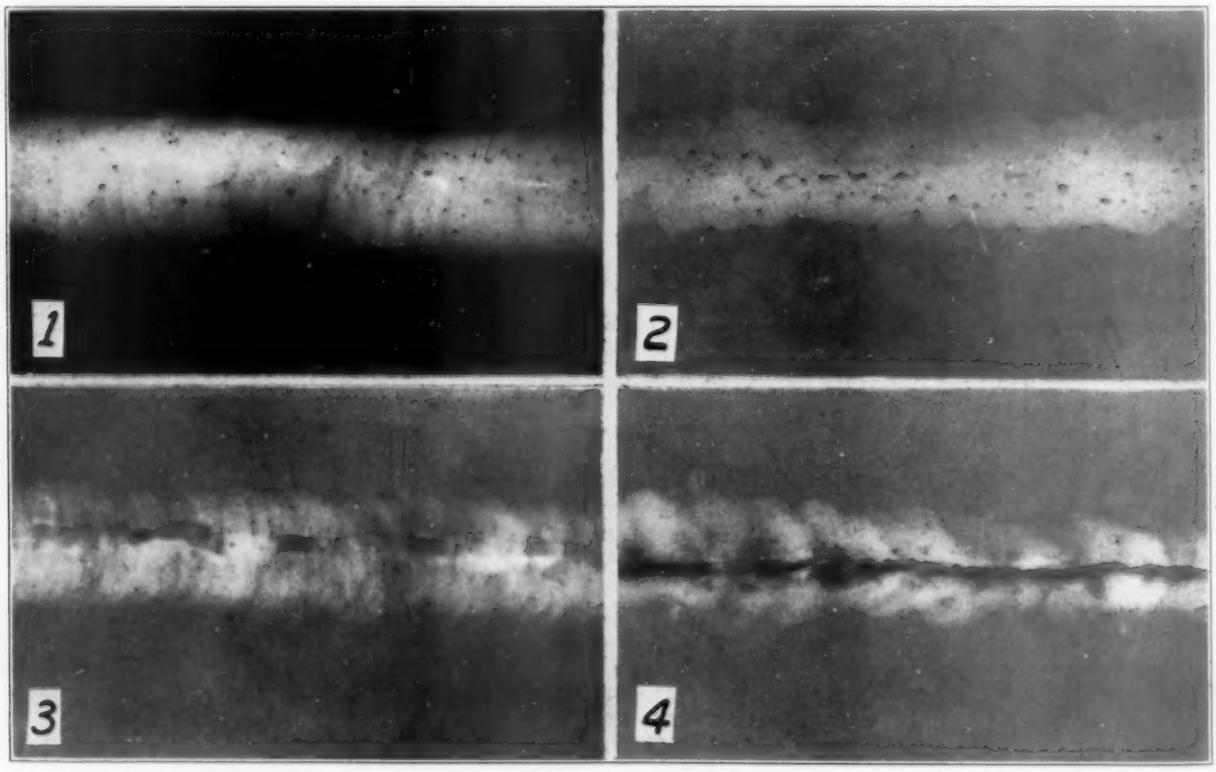
An Oxweld Portable Tensile Testing Machine was brought to the January meeting through the courtesy of the Linde Air Products Company, and Mr. Fred Outcalt of that company described the machine and explained its purpose and supervised the making of tensile tests on coupons cut from the welded tank.

The first coupon pulled was cut from the parent metal of the tank. It showed a breaking strength of 55,200 lbs. per square inch. Two coupons were cut so as to include weld No. 1, one of these being solid and the other having a ¼" hole drilled through the weld. Both of these coupons broke outside of the weld, one of them at 40,000 lbs. and the other at 47,000 lbs. (The reason for this low breaking strength is that the specimen had been made up by welding together a section of 18" lap welded pipe which had been split in two parts with the cutting torch. Weld No. 1 was very close to the original lap weld in the pipe. When these two coupons were pulled in the machine, it was this lap weld which let go.)

A solid coupon including weld No. 2 broke outside the weld at 52,800 lbs. A coupon which had been drilled through the weld broke in the weld at 65,400 lbs.

Both of the coupons which included weld No. 3 broke in the weld; one of them at 46,400 lbs. and the other at 43,500 lbs.

One of the coupons including weld No. 4 fell apart while it was being ground flush. The other coupon broke at 10,000 lbs. This was obviously a very poor specimen, as a visual examination showed the penetration to be very poor. These



The Differences in Character of these Four Welds as Shown by the X-Ray Were Confirmed by Tensile Tests.

tests were not conducted to show the comparative merits of different methods or of different materials. Different materials were used so that the various methods of inspection would be sure to produce different results, and the purpose of the whole program was to demonstrate how the various inspection and test methods could be used in combination as a check on the strength of welds. The meetings at which these tests were conducted were well attended, and it was evident that the interest in inspection and testing in the Chicago district is very high.

PROPOSED ALL-METAL APARTMENT HOUSE UTILIZES WELDING

Detailed plans have been prepared of an all-metal apartment house which is proposed to be erected in Chicago, utilizing floors of the welded battledeck type or similar construction, and sheets of Allegheny metal fastened to the framework to form the walls. Bowman Brothers, Inc., are the architects, and the preliminaries were designed by C. H. Westcott.

It is proposed to use electric heat, running the heat ducts under the floors and eliminating all radiators. All rooms are to be tastefully decorated and supplied with indirect light, and the kitchens will be equipped with electric ranges, refrigeration and mechanical ventilation. All cabinets are metal.

Because of the savings effected in the increase in rentable space provided by the special construction, floor space can be rented at no greater unit cost than that of the usual type of apartment.

The walls are estimated to cost only approximately $1.53 per square foot of surface, including insulation, metal lath, and plaster, which is considerably lower than the estimate of $2.17 per square foot for masonry walls, and maintenance is almost nil. Moreover, the special construction and double-glazed windows are said to reduce the heat loss to less than half that experienced in the usual type of fireproof construction.

Various types of floor construction were considered, but the steel battledeck floor was decided upon as being the most economical.

The plans of the apartment house as drawn show two frontage lines of 42 and 42.5 ft., respectively, both making an acute angle at the point of meeting. The other two plan dimensions are 40 and 29 ft.

The saving in weight effected by the metal walls, steel-plate floors, and reduced height made possible by this construction, results in a considerable reduction in the load on the foundations. For example, based on a building height of 20 stories, a typical interior column will require 18 piles for metal construction as against 30 for the conventional type of building. For a wall column, the numbers will be 11 and 21, respectively. The H-section columns and the girders will be considerably lighter in weight than in the usual type of construction, since the floor panel has been reduced in weight an amount almost equal to the live load. In this case, the saving in the cost of columns and footings is estimated at about 15 cents per square foot over the gross area of the building.

The floor plates may be welded to the I-beams in the field, or, as has been proposed, the plates and beams can be shop welded and then bolted in the field, in which case the shop assembly would consist of a wide plate with beams and channels welded to the underside on 24-in. centers, there being two I-beams in the middle and a channel along each of the two edges.

Another important item affected by this type of construction is the saving in construction time. The floors and walls are quickly assembled onto the steel framework; there is no interference by bad weather; false flooring is eliminated; very little form work or scaffolding is required; and sub-contracts can be coordinated more easily, as all the floors are available as soon as the steel is erected.

ATTENDANCE FIGURES SHOW STEADY INCREASE AT IOWA WELDING CONFERENCES

Iowa State College at Ames, Iowa, held its third annual conference January 21, 22 and 23, under the auspices of the Engineering Extension Service. The program of papers was as follows:

Arc Welding, the Modern "Putting on" Tool, K. L. Hansen, K. L. Hansen Engrg. Co., Inc.

Welded Piping in Various Fields, A. L. Breyvogel, Tube Turns, Inc.

Developments in Structural Welding, F. S. Peasley, General Electric Co.

Motion Pictures "Overland Pipe Lines" and "Panel Heating," Linde Air Products Co.

Copper and Bronze in the Welding Shop, W. C. Swift, American Brass Co.

Hard Facing Wearing Surfaces, E. F. Smith, Haynes Stellite Co.

Welding with the Shielded Arc, E. W. P. Smith, Lincoln Electric Co.

The Future of the Welding Shop, H. S. Card, Editor, THE WELDING ENGINEER.

Welding Special Corrosion Resisting Steels, G. Van Dyke, Joseph T. Ryerson & Son, Inc.

Practical Weld Testing Methods, W. B. Browning, Linde Air Products Co.

Training Welders in the Plumbing and Heating Industry, F. J. Maeurer, Air Reduction Sales Co.

Automatic Arc Welding in Industry, R. F. Castner, Westinghouse Elec. & Mfg. Co.

Battle Deck Floors, Henry Penn, American Institute of Steel Constr.

The Business Side of Welding, C. G. Stuben, Linde Air Products Co.

Welders Round Table. Discussion of Special Problems.

Motion Picture, "The Magic Flame," Air Reduction Sales Co.

Between the lecture periods the visitors at the conference had an opportunity to see exhibits and demonstrations of a number of makes of welding equipment and supplies. The attendance at all lectures was large enough to fill the lecture room to capacity. In fact, the registration record for the three welding conferences which have been held at Iowa State College tells the story of increased interest. In 1929 there were 112 registrations; in 1930—168; in 1931—241; that is, the registration this year was more than double that of two years ago. This may be accounted for to some extent by the increased interest in welding, but a large measure of credit is due to Prof. D. C. Faber, Director of the Engineering Extension Service, for his excellent work in arranging programs which appeal to the welding-minded people of that district.

GILMORE MADE PRESIDENT OF CHICAGO ASSOCIATION OF CONSULTING ENGINEERS

At the annual meeting and election of officers of the Chicago Association of Consulting Engineers last month, Rollo E. Gilmore was elected president for the coming year. This Association is composed of prominent Chicago consulting engineers whose work is national in scope in the design of mechanical, electrical and sanitary equipment in the building industry. Mr. Gilmore is well-known amongst the welding fraternity in the Chicago district, and during the convention of the International Acetylene Association, which was held in Chicago last November, he presided at the technical session which was devoted to the subject of welded piping in buildings.

Resistance Welding of Motor Frames*

Steel Slabs Furnished by the Mill in the Right Size for Fabricating Are Quickly Rolled and Welded into Perfect Rings

By Malcolm Thomson†

THE continual demands of modern industry have caused and are causing a continual revision of methods employed. Perhaps no more interesting application of electricity to shop manufacture occurs than in its use in various forms of electric welding. The methods in most common use are the arc methods, the carbon arc and the metallic arc, and the resistance method. The carbon arc process was invented by DeMeritens in France in 1881 and the metallic arc process by Slavianoff in Russia in 1890. The resistance welding process was invented by Dr. Elihu Thomson in 1886. It is this latter process which is particularly adapted for use where there is mass production.

In the manufacture of motor frames, competition brings

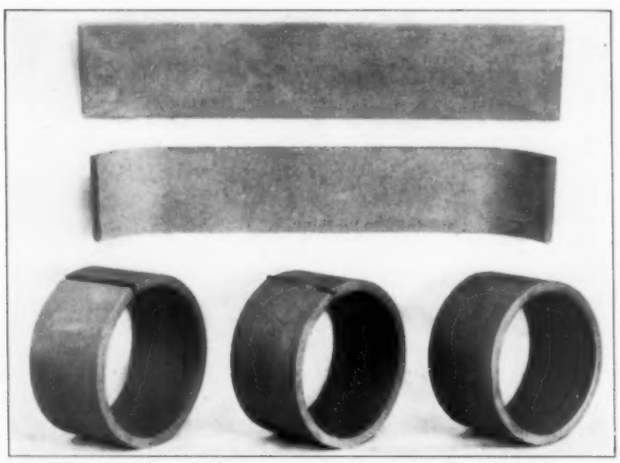


Fig. 1.—Successive Steps in Forming and Finishing Steel Rings.

in the question of reduced costs. It was, therefore, natural that the plant with which I am connected took steps in 1928 to equip a modern shop for fabrication of motor frames, as well as other products which could be fabricated from structural steel. A section of a building formerly used as a steel foundry was set aside for this purpose. It is my purpose here only to briefly outline the manufacture of rings for frames of D.C. motors.

The steel for the rings is ordered from the mills in carload lots cut to proper width and length, the length being figured so as to include the necessary amount for welding and sizing operations. The steel which has been found most suitable for magnet frames is basic open hearth process manufacture of low carbon content. The slabs of steel are unloaded at one end of the department, and are of various sizes in accordance with different sizes of magnet frames. The slabs are passed to a 1,200 ton hydraulic press in order to have the ends crimped or curled to avoid flats and hence waste of stock at portions which cannot be rolled.

Fig. 1 is a view showing the steel as purchased, as crimped, and also rings as rolled, welded, and sized.

Fig. 2 shows a typical ring in bending rolls. Attention is called to vertical plate which insures accurate alignment of ends of ring during rolling process. The rolls have electric motor drive for raising and lowering rolls, as well as motor drive for rolls. End section is pivoted and is controlled by air cylinder which shows plainly in this view. This feature is for quick removal of rings.

From the rolls the rings pass onto conveyor which has considerable storage capacity to a specially designed Thomson-Gibb resistance flash welder.

Fig. 3 shows this welder in action. The rings are held with powerful clamps actuated by hydraulic cylinders against special aluminum bronze die blocks. The operator separates the ends of the rings slightly, then starts slowly feeding the jaws of the machine together with hand valve control of hydraulic push-up cylinder. The current is turned on by a push button working a small contactor which in turn controls the large contractor, the latter closing the connection of primary of transformer to power lines. As the ends of the ring meet, at first feeble then violent flashing occurs. A predetermined amount is flashed off, averaging slightly less than an inch total. The flashing heats the abutting faces to the melting point of steel and the area immediately behind to a welding heat mainly by conduction, but partly by resistance. At the end of the flashing period, the full pressure of the hydraulic ram or about 100,000 pounds is applied suddenly, forcing the molten faces together. The result is a perfect and homogeneous weld, all burnt or oxidized metal is forced out. This welder while rated at 12 square inches maximum cross section is used on sections up to 18 square inches. The welder has a 750 KVA water-cooled transformer. The open circuit voltage at welding jaws is 12 volts.

The demands on welding transformers call for different features of design than those used with the usual types. The service is intermittent but large amounts of current are necessary, particularly at the final or upset period of the welding cycle. Due to the severe nature of the service, accessibility is an important feature, hence the coils are usually assembled on a straight core section, then a "U" shaped section is placed in position and fastened to straight section with bolts and straps. This allows for more easy repair in case of trouble. On 60 cycle supply, the core is worked at a flux density of 60,000 to 80,000 lines per square inch.

The secondary is usually of cast copper with cooling tubes for water cast in and of single turn type. In larger transformers usually a number of cast copper sections are connected in parallel. The ends of the copper secondary are machined, one end being fastened solidly to the fixed platen. The other end is bolted to a flexible lead made up of many thin sections of copper strip, this lead being connected to a movable platen. The welding dies are located on top of the platens and are of hard rolled copper or special wear resisting material, depending on the nature of service. The work is very solidly clamped to the die blocks because of the push-up pressure required. The cast copper is worked at a current density of 1,800 to 2,200 amperes per square inch; the flexible leads at 2,000 to 2,400 amperes per square inch and the joints at 400 to 600 amperes per square inch. The dies are worked at about 3,000 amperes per square inch current density. Dies and platen are wherever possible, water cooled internally. The two sides of the secondary are kept as close

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*A paper presented before the Midwinter Convention of the A. I. E. E., January, 1931.

†Thomson Research Laboratory, West Lynn, Mass.

together as possible and the length of this circuit kept at a minimum to avoid any unnecessary secondary voltage drop.

Primary coils of the larger type transformers are usually built up of copper strip insulated between layers by a sleeve of cloth or layer of asbestos paper. The coils are impregnated and baked and then wound with tape and finally painted.

Voltage regulation on the primary is obtained either by use of a separate auto transformer or by bringing out taps, a regulating switch being employed. Usually there are from five to ten points of voltage regulation, the lowest being about 50 per cent of the highest.

Contactors used to switch on the power supply must be able to break the full load of the welder without undue arcing. On production work the breaking of the current may occur several times a minute.

The transformers are usually designed for one particular job; that is, a transformer designed for flash welding of steel would not be suitable for fast upsetting, and one designed for steel not suitable for welding copper or aluminum.

The transformer in the Thomson-Gibb machine described was designed especially for welding rings up to 12 square inches cross section, but as before stated, is used on somewhat heavier sections also.

Readings taken while welding a section of 18 square inches show that there is a primary current of about 900 amperes taken during the flashing period with a peak load of 2250 amperes at the final or completion period of weld when ring is forced together. The primary voltage is 236. Current is at 60 cycle frequency. At high point of weld, readings taken show 461,250 volt amperes and 252,000 watts which gives a power factor of about 55%. The average watts during flashing is 126,000. 1400 watts are taken with secondary open.

Oscillograph records have been made on this welder. The conditions at start of flash are; first a brief interval of short circuit, then open circuit followed by beginning of contact of pieces. This represents period of feeble flashing. Toward the end of the flashing period, when flashing appears continuous, the wave form still shows no continuous flow of current, but rather closely compact intervals of short circuit and open circuit.

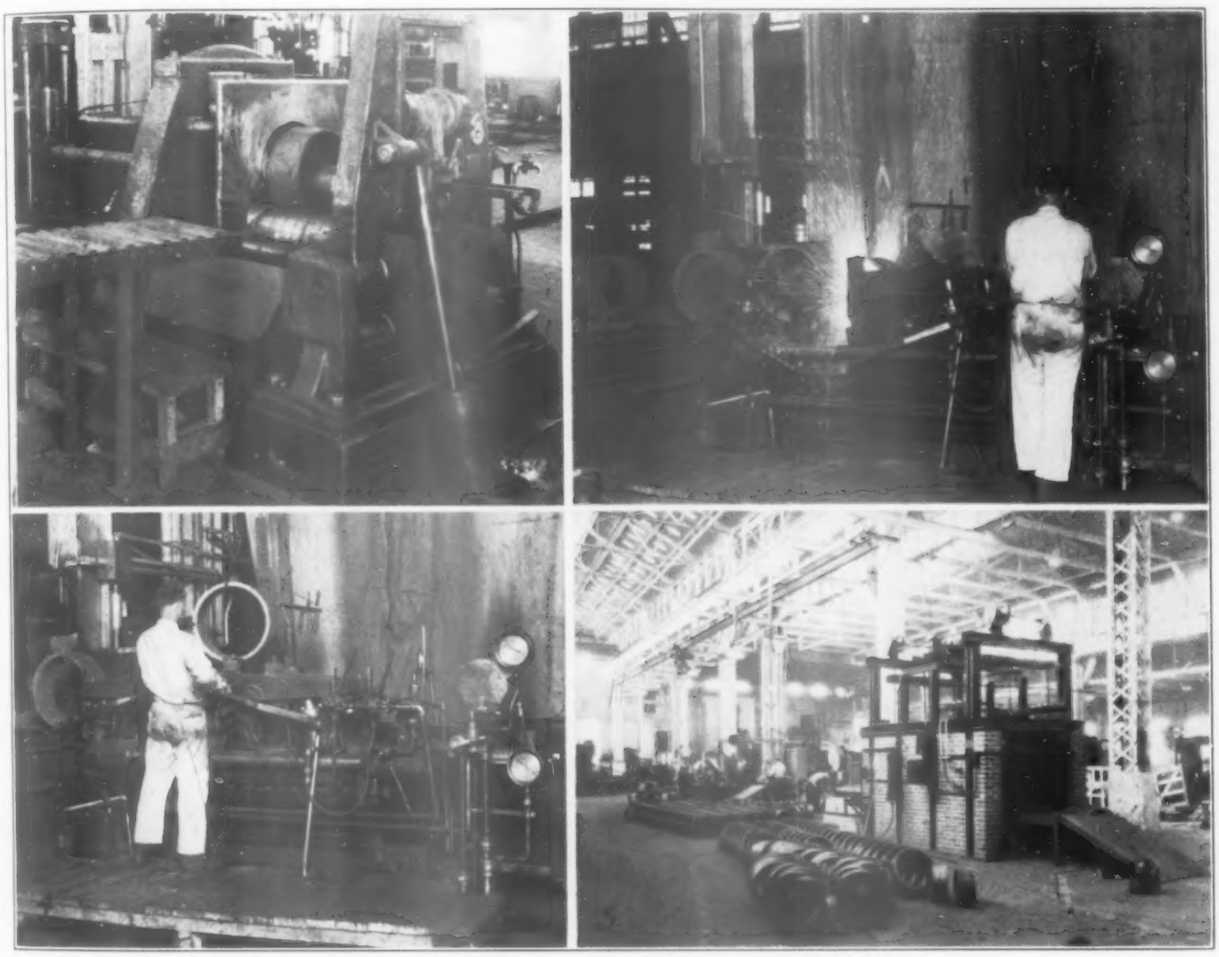


Fig. 2.—The Ring in the Bending Rolls. Fig. 3.—The Flash Welder in Action. Fig. 4.—An Electric Crane Removes Welded Ring from the Machine. Fig. 5.—Finished Rings with Feet Welded on.

After welding operation is completed, ring is removed by electric hoist shown in Fig. 4. The upset and flash resulting from the welding operation do not show clearly in this view, but it has to be removed. The operation is done in a vertical motor driven broach which trims outside and inside while metal is still red hot. The rings then pass by conveyor similar to that previously shown to electric furnace. The electric furnace, while primarily for heating rings for sizing, also is advantageous in that it gives a strain anneal. The furnace is shown in Fig. 5. The rings on the floor are complete rings ready for shipment. Those in the front rows have feet welded on.

The rings are heated to about 1400°F in the furnace and then pass down a slide to an eight cylinder hydraulic press located in the floor. The press is so constructed that each cylinder has a removable head portion so that various sizes of rings may be accommodated. The rings are lowered horizontally into press by means of an air operated table

and then squeezed to vary $\frac{1}{8}$-in. to $\frac{3}{32}$-in. of correct size, depending on size of ring.

The ring is now complete with exception of feet. The feet are made from steel bent into a U form in hydraulic press, then cut apart with a gas cutting torch. Each U makes one pair of feet and by inverting the U's rights or lefts are made. It is our practice to cut all four feet at once using a double torch machine for this purpose.

The sized rings pass by conveyor to arc welding stations where the feet are tack welded, then finish welded into place. The completed frames are than sand-blasted, after which they are shipped to the motor building for machining and assembly.

Some of the rings are for automotive equipment and do not have feet. These latter rings have drop-forged arms and bearing retainers welded in place by metallic arc process.

In conclusion, by the use of electric welding of two kinds, we have been able to produce frames 25% to 50% cheaper than corresponding steel castings with the added advantage of much greater uniformity in dimensions and structure. This, in turn, reflects in lowering machining costs and better motors.

WELDING SOCIETY FORMED IN ST. LOUIS

On January 23, at a meeting held in the Forest Park Hotel, St. Louis, the St. Louis Welding Society was formed, and officers elected. This society, which consists of 65 charter members representing 26 companies in St. Louis, East St. Louis, and Madison, Illinois, was the outgrowth of monthly meetings on the subject of welding, conducted by the Hill Equipment Engineering Co., of St. Louis. Temporary headquarters of the society were established at 4620 Delmar Blvd., the home of the Hill Equipment Engineering Company.

The following men were elected as officers: President, E. P. Barnes of Moloney Electric Co.; Vice President, W. D. Patterson, American School of Welding; Secretary and Treasurer, Basil N. Osmin, Hill Equipment Engineering Co.; Directors, F. J. Feldhaus, Heine Boiler Company; Geo. Frankey, Alpha Tank & Sheet Metal Works; A. V. Fausek, Modern Engineering Company; Lyman Goodin, Midwest Piping & Supply Co.; F. Tidwell, John Nooter Boiler Works; A. E. Eidson, St. Louis Structural Steel Co.

Future plans of the society, though not definitely announced, include observation and educational tours through St. Louis factories who utilize welding processes in the fabrication of their products. Also lectures by men prominent in the welding industry.

The Hill Equipment Engineering Co., who are responsible for the formation of the St. Louis Welding Society, is the exclusive dealer for products of the Lincoln Electric Co., Cleveland, Ohio, in the Eastern Missouri and Southern Illinois territory. This company is headed by Lockwood Hill, a pioneer in the arc welding field. Mr. Hill has specialized in welding and sold the first arc welders in the St. Louis territory, early in his business career.

LOS ANGELES SECTION OF A. W. S. HOLDS FIRST 1931 MEETING

The first meeting of the year of the Los Angeles Section of the American Welding Society was held at the Engineers' Club the evening of January 19th. The purpose of the meeting was the inauguration of officers and a discussion of plans for 1931.

The officers elected for the ensuing year are, Mr. Paul E. Jeffers, Consulting Engineer, Chairman, Mr. W. A. F. Millinger, M. E., with the Shell Oil Co., Vice-Chairman and Mr. Eric Barnett, Research Engineer with the Columbia Steel Co., Secretary and Treasurer.

Mr. Jeffers, the new chairman is widely known throughout Southern California, and is recognized as one of the highest authorities in structural steel construction work. Mr. Jeffers is especially interested at this time in the development of structural steel welding.

During the meeting Mr. Millinger, retiring chairman, spoke on "Budgeting Our Facts," which was well illustrated by comparisons and facts pertaining to the society. Mr. Millinger followed this talk with an address to a group of student welders from the Frank Wiggins Trade School.

A motion picture of "Welding the Upper Carnegie Building" at Cleveland, O., was shown through the courtesy of the Lincoln Electric Company, after which there were discussions regarding the physics and metallurgy of welding, the effects of cold working welds and then hot working them with additional weld metal. It was fittingly pointed out that welding needs more technical engineers, who might be termed welding engineers, not to be confused with the practical welder who has grown up with the trade; but rather mechanical engineers capable of dealing with scientific analysis to determine by calculation, or otherwise, the forces involved by the fusion welding of metals.

547 MILES OF PIPE TO BE WELDED

The last five months of 1930 have shown the greatest advance in the electric welded field joints of pipe lines since this method was first adopted several years ago, according to an announcement received from The Welding Engineering Company of Bartlesville, Oklahoma. From July 24th to the end of the year they have completed the welding of 452 miles of large diameter gas pipe. They indicate that the increased use of electric welding on large diameter lines has been caused by the advent of the heavily coated rod and development of the shielded arc. By the use of this process greater strength and ductility have been obtained. In the

Making Bell Hole Weld on Cities Service 20" Gas Line Near Wellington, Kansas

452 miles there were over 40,000 welds. Most of this pipe was 20" to 24" in diameter, but to date not a single weld has been reported cracked or broken, either during construction or while in use. The following lines were welded during the period above mentioned:

Cities Service Gas Company's Line from Dilworth, Oklahoma, to Wellington, Kansas, 32 miles of 20" solid welded.

Missouri-Kansas Pipe Line Company Lateral Lines in the Texas Panhandle, 24 miles of 18" and 20" welded and coupled.

United Gas Company 90 miles between Refugio and Kenedy, and Converse and San Marcus, Texas, 12", 16" and 18" welded and coupled.

The Continental Construction Corporation (Chicago Line) 306 miles in Texas, Oklahoma, Kansas and Iowa, 24" welded and coupled.

In addition to the above mileage completed in 1930, the Welding Engineering Company has uncompleted contracts of electric welding totaling 547 miles.

Welding in Home Building*

A Practical and Flexible Type of Design for Welded Steel Framework for Small and Medium Sized Residences

By E. H. Ewertz†

THE history of the world clearly shows that there is no human convenience or comfort of a more variable and changing design than that which we call our home.

Available materials and climatic conditions naturally determine the types of homes used; also, the ingenuity of man has been more active in the improvement of our homes than in any other field and consequently advancement has been most rapid.

Conservatism is a desirable safeguard against unsuitable and uneconomical progress, but at times also a handicap. We find homes today that are lacking in merit sometimes due to natural conditions but more often due to poor conservatism and failure to keep posted on available, more suitable materials, and improved methods of construction. The architects and engineers giving their all to home construction and the many fine publications, easily obtainable, leave little excuse for homes not being as comfortable and lasting as they should be, consistent with their market value.

We all seek warmth in a home, but few realize that it is produced by a peculiar touch, not accomplished by the expenditure of large sums of money, but by the nature of the one guiding the harmonizing of an interior with a proper exterior. Therefore, while warmth may be found in palatial homes, it is also and more frequently found in humbler dwellings.

Contrary to notions so often expressed, practically any kind of material can, when properly blended, produce the desired warmth.

A fine waxed and polished tiled floor with suitable rugs is as cozy as any wood floor treated in the same manner. Bedrooms fitted with suitable all-welded steel furniture do not lack warmth and are more permanent and sanitary.

Gradually our ideas change and we often, without any particular reason, accept as a matter of fact innovations that have only been produced by the vision and unselfish effort of those devoted to the art of home construction.

Sanitation and health of our people is now being given proper consideration and is reflected in our homes. We know pure light and air are essential, and the all-welded steel casement windows with good glass give more light, and when open, more air, than can be obtained from any other type. Such windows, when closed, eliminate the very undesirable draft and so help to maintain uniform interior heat.

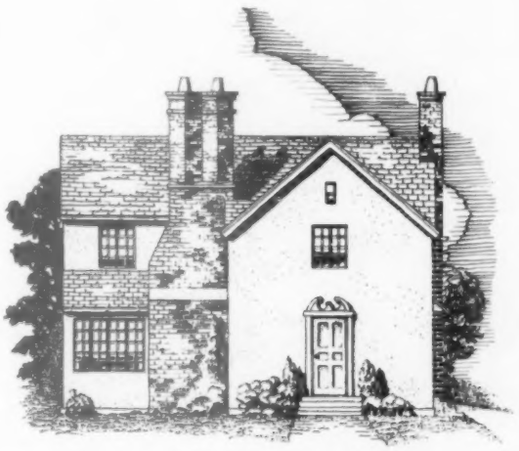
Heating systems with distributing piping as well as cold air supply are, when welded, always tight; therefore, sanitary and dustless.

Leaky joints in hot and cold water piping not only makes visible damage but tends to destroy the structure, and more seriously, effects the sanitation; a condition we are now able to eliminate by the use of all-welded piping, making all of the parts as one from the supply to the distributing point.

All-welded steel heating boilers and hot water heaters are now common, due to their improved quality and longer life. As a matter of fact few of us realize in how many ways the use of welding has helped to increase the warmth of our homes, because we do not know or question methods of manufacture.

Cooking utensils, plumbing fixtures, garden implements, even our radio and automobile have many welded parts, all for the sake of making our home and outdoor life more comfortable.

The but natural consequence of the usefulness of welding of the many details that make up our home and the warmth found in the use of many materials have lead the students of the art to produce a main structure for our homes of all-welded steel; and, while progress is slow in all new ventures and should be slow to avoid errors we now have a good many houses of all-steel framing and some of the all-welded types.



Homes of this Type May Readily Be Designed for Welded Construction.

While there are several types of all-welded steel home construction, the description of one will clearly show the general idea of them all.

It must be borne in mind that as both outside form and interior arrangement takes on many variations, any type of construction must be flexible so as not to retard the architect or owner in obtaining a desired result. This of course eliminates the mass production as well as the ready made types of homes, types only to be found where acute need has compelled such construction to be resorted to.

The all-welded steel house we wish to describe is very similar to the wood-frame house and therefore as natural to deal with and as flexible in its applications.

The foundation can be of any construction but concrete properly waterproofed is probably the least expensive, consistent with good engineering, and lends itself to ease of anchoring the steel structure.

There are two types of construction now available. One where the steel members are assembled on the ground adjacent to the site, permitting large sections to be raised up and even set in recesses in the foundation walls and anchored by grouting them in; the other type, where sections of transportable size and sufficiently light for two men to handle, are fabricated in the shop all complete ready for erection, but in both types the details are the same.

The steel framing is made up of studs, beams, caps, sills,

*Paper read before the thirty-first annual convention—International Acetylene Association, Chicago, Ill., November 12, 13, 14, 1930.

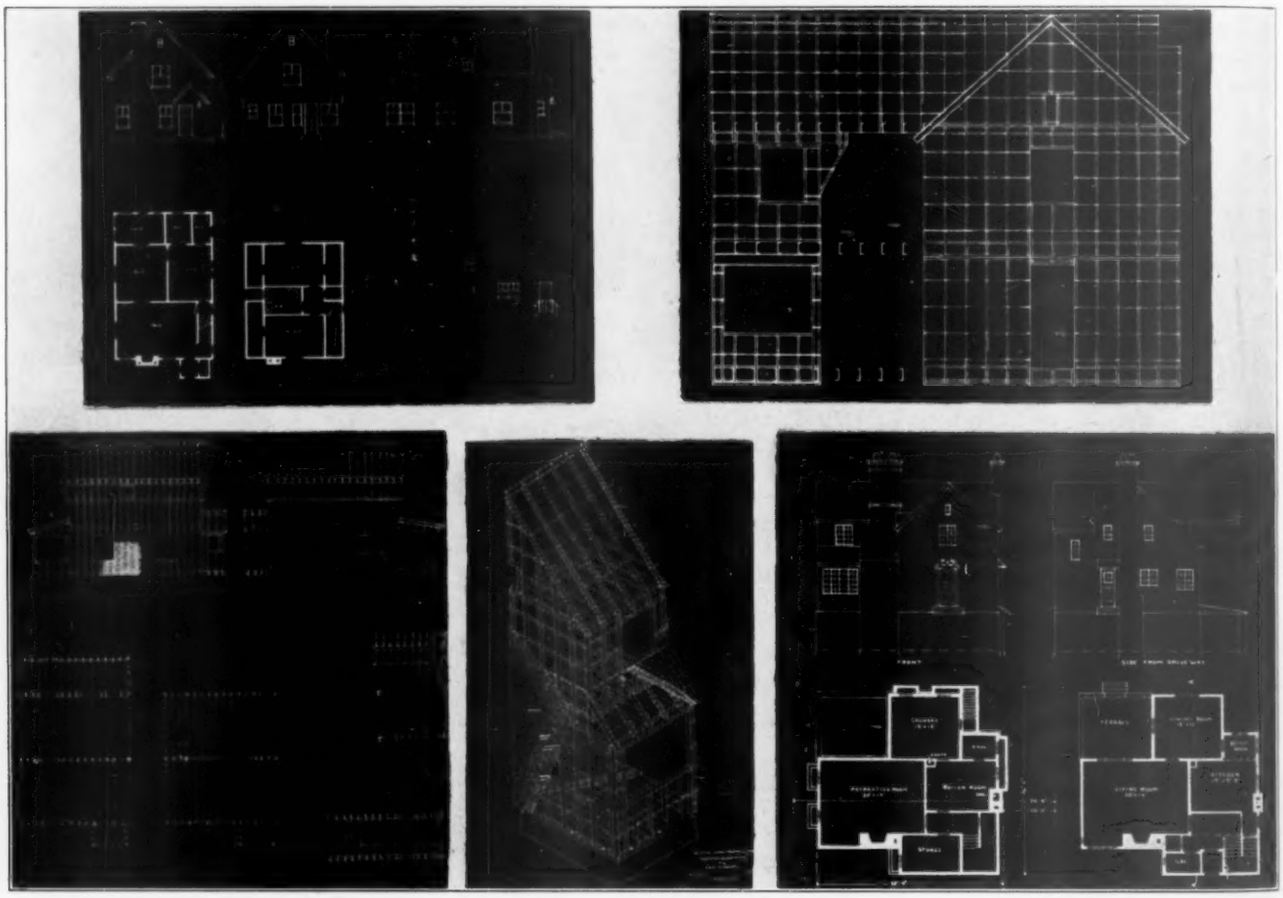
†Consulting Engineer, New York, N. Y.

rafters and ridge pole all of a heavy sheet steel channel rolled to a special form similar to what in the building trade is known as metal lumber but modified to increase the strength. In general, the strength of this channel is slightly more than the corresponding size of building lumber.

The studding for an average size house is 4-in. channels spaced 16 to 18-inches apart and horizontally braced with 1/8-in. thick flat bars spaced about 24-inches apart. At upper and under side of beams 1¼-in. angles are welded to studs and beams for support of floors and ceilings. Framing for door and window openings are same as studs.

Beams, depending on length and load are from 8- to 10-in. channels, also braced top and bottom by ⅛-in. flat bars on 24-in. spacing.

Load partitions are studded like outer walls, other partitions can be light hollow tile or smaller channels like the special kind now on the market known as Steeltex partitions.



Floor Plans, Elevations and Framework Details Have Been Prepared for Prospective Builders of Welded Steel Frame Residences.

Rafters are of 6- to 7-in. channels also braced by flat bars and with angles at bottom edges.

Where load conditions require extra strength, double channels interbraced are used.

Stairs are built with channels forming the stringers with flat bars and angles forming the steps and risers.

Metal lath is wired on to the flat bars on both sides of studding as well as both sides of beams and rafters.

The special form steel channels can readily be obtained in reasonable lengths and can be cut to size and form required by portable high speed saw or by the gas torch.

All steel material is fabricated in the shop and properly marked for ease of assembly.

As soon as studding is in place the beams can be placed in position, braced, and welded; the whole erection is accomplished in short time and when welded is ready for painting, installation of piping, and electric wire conduits, after which the metal lath is applied.

The welding operation is of course very simple as acetylene and oxygen gases and gas welders are available everywhere. Further, because of the relative lightness of all the steel material, most of it about 14 gauge, the welding can be performed by use of either bronze or steel welding wire giving a strong bond without excessive lengths of welds and definite instructions are given as to where welds are to be made and size of same.

With the metal lath in place the outer walls may be finished with stucco, veneer brick, stone, or combinations thereof and interior walls as well as ceilings plastered.

Cement is used as base for floors but the finish may be plastic cement in form of tiles, waxed and polished, or a wood floor may be laid on the cement base.

Roofs have porous cement or similar material as base and can be finished by any of the many kinds of roof covering now on the market.

At each floor the cement base is carried out to the outer walls to form a fire barrier and also dividing the dead air space into smaller units.

The dead air space formed between the inner and outer as well as the upper and lower covering produces the air space which insulates the house preventing heat or cold passing through and also eliminating transfer of noise.

From the above brief description it is evident that the most costly item in home construction, that of labor, has been materially reduced and the time required to erect a building is cut in half or better.

While steel is relatively more expensive than wood the final cost will be about the same and in addition the house is fireproof, able to withstand severe storms, probably even cyclones and earthquakes; a home that is sanitary, inexpen-

ive to maintain, properly insulated, therefore easy to keep arm; all with an outer appearance and inner arrangement roducing the warmth we all want in our homes.

The average home of six rooms with kitchen, bath, and un porch will require about 15,000 lbs. of steel, including he metal lath, about 800 linear feet of welding, and some 0 lbs. of welding wire.

From Government building statistics we find that the mini- num average number of homes built in the United States uring a year is 350,000.

Assuming that half of this number, or 175,000 homes, were f steel construction we find, based on the six room house ata, that we would consume 1,312,500 tons of sheet steel, ,700 tons of welding wire, 49,000,000 cubic feet of oxygen, nd 46,000,000 cubic feet of acetylene. Also we would use pproximately 3,000 welding torches. No doubt considerable as would be used for cutting even though a circular saw ould prove more economical.

While this paper in general is based on facts, certain con- ervative assumptions have been made in order to more learly bring to you a picture of what we believe the near uture will show as an accomplished fact.

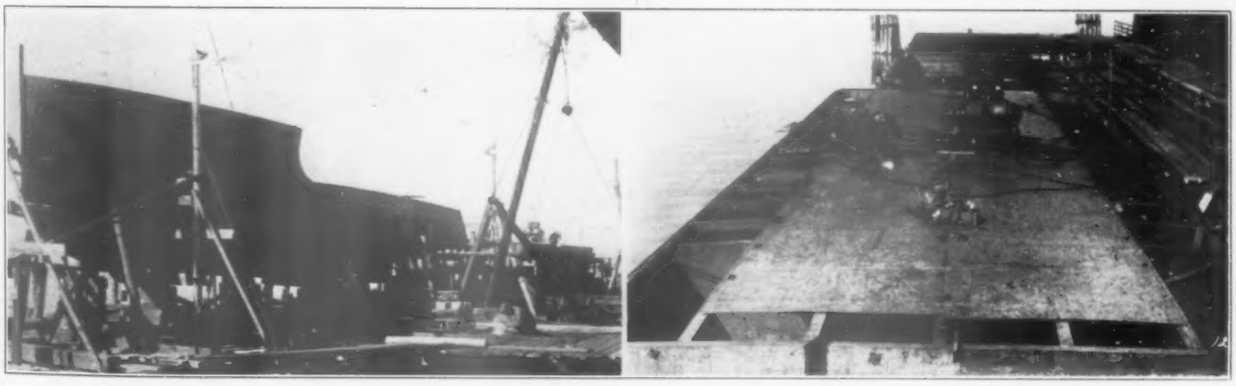
WELDING CONFERENCE AT OREGON STATE AGRICULTURAL COLLEGE

A welding conference will be held at Oregon State Agri- ultural College, Corvallis, Oregon, on February 26th and 7th. This is the third year that such a conference has been eld. It follows very shortly after the Western Metal Con- ress at San Francisco, and therefore a number of prom- nent engineers in the welding industry in the eastern states ave made plans to go from San Francisco up to the Oregon vent before returning home. Advance reports indicate that splendid program of papers on interesting welding sub- ects has been arranged, and, as usual, there will be demon- trations of processes and exhibits of welding equipment and materials. The conference is under the direction of Prof. George B. Cox, director of the Engineering Shops.

CLEVELAND CONFERENCE WILL FEATURE DESIGN

The formal announcement of the conference on welding to be held at Case School of Applied Science, Cleveland, Ohio, February 19 and 20, under the direction of Case School of Applied Science and the Cleveland Engineering Society, describes this event as a two day educational conference presenting: demonstrations of the latest equipment, materials and methods used in the various welding processes; problems of welding as applied to manufacturing, maintenance, and construction. Special emphasis will be given to design of welded structures and machines, and to the influence of welding on the proportioning of such structures and machines.

Subject to be presented include:
New Developments in Welding
Thermit Welding
Oxy-Acetylene Welding
Arc and Atomic Hydrogen Welding
Fusion Welding of Pressure Vessels
Welding of Machine Parts and Frames
Welding of Pipe Lines
Designing for Welding
Testing Welds and Welders
Welding of Structures
Exhibits and Demonstrations include:
Gas Welding and Cutting
Thermit Welding
Atomic Hydrogen Welding
Automatic Arc Welding
Resistance Welding
Welding Special Metals
Tested Welds and Welding Materials.



BUILDING WELDED BOATS FOR THE ARMY

The Hampton Roads Shipbuilding Corporation, Ports- outh, Virginia, have been doing some interesting construc- ion work for the War Department which involves a nsiderable amount of arc welding. One of these jobs is signated as a hoist vessel, plans for which were prepared the Transportation Service Office of the War Department. his vessel will be used in lifting weights from the water or rom piers and for the salvaging of fallen airplanes. The ntire shell together with stem, stern frame, rudder and rud- r quadrant, bits, chocks and cleats are welded.

The hull is designed with straight lined cross-sections elim- ating furnace work and allowing welding to be done with se and efficiency. The longitudinal framing system is used conjunction with transverse frames which are more widely aced than is usual with transverse framed ships. It is ought that this type of vessel, due to its adaptability to elding and ease of construction, should be much in demand.

The shell is of plates ¼" to ⅜" thick. Longitudinal seams are angle planed to about 45 degrees with a space of ⅛" allowed between joints at the bottom. These seams are continuous welded to 4"x3" tees. The joints of the plates being in the center of the 3" dimension on the inside, the plates are tack welded to Tee sections, the tack welds being about 1¼" long spaced on about 3" centers and staggered. The construction of decks, bulk heads and superstructures is similar to the shell construction.

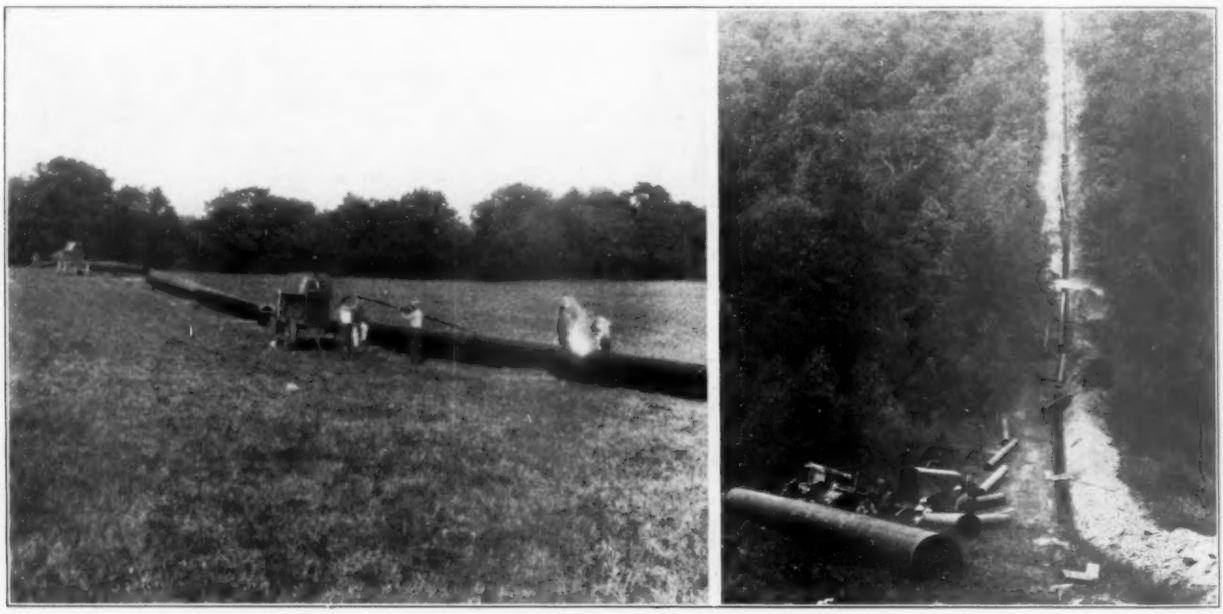
An all welded steel barge is another type of boat which this company is building for the War Department. In the construction of this, much weight has been saved due to welding, and this has greatly increased the carrying capacity of the barge without sacrificing strength. The illustrations show "Hobart" arc welding generators at work on these two constructions, the hosting vessel being shown at the left and the barge at the right.

Pipe Line Welding

How the A. O. Smith Corporation, of Milwaukee, Has Developed Special Piping and Methods of Installing It

By W. T. Graham†

THE distribution of natural gas and transportation of crude oil through large diameter pipe lines has increased tremendously during the past three to four years. Since distribution points in most instances have been so far removed from sources of supply, many hundreds of miles of pipe lines have been necessary. To economically transport these natural fuels such long distances, new products, new construction methods and much greater capacity of manufacturing and laying large diameter pipe were required. So, in order to reduce the tremendous cost of material and construction of these long lines and to make their installation more permanent with no losses due to failure or leaks during operation, many new products and methods have been engineered into the picture.



Across the Plains and Over the Mountains Hundreds of Miles of Welded Pipe Were Laid Last Year for the Transportation of Gas and Oil.

The A. O. Smith Corporation had for some time been furnishing couplings, return bends, many types of high pressure vessels, and other refinery equipment to the oil industry. This material was produced by a highly specialized electric welding process. It was a logical step to apply this process known as the "Smithweld" to the manufacture of large diameter pipe.

When A. O. Smith entered this field, the total capacity of the country for pipe in diameters over 20 inches was less than three miles per day. Inside of three years the capacity of the A. O. Smith pipe mills has been built up to 32 miles per day in diameters from 8-in. to 26-in. inclusive.

This new method of pipe fabrication made possible the use of stronger steel, which cut down unnecessary wall thickness, thus reducing the weight of pipe required for given pressures, to say nothing of the substantial shipping and hauling economies. Unusual manufacturing methods also make it possible to produce pipe in uniform lengths of 30 and 40 feet; one mill being equipped to produce 30 ft. lengths at the rate of 12 miles per day, and the other to produce 40 ft. lengths at the rate of 20 miles per day.

These longer uniform lengths have cut down the handling and joining time in the field, since every joint laid and joined results in exactly 30 or 40 feet of line instead of the customary 18 to 20 ft. The per joint weight in spite of this added length is not greater than the shorter lengths made by the old methods since in most cases the thinner wall compensates for the weight of the added length per joint.

Plates of proper dimensions are furnished by the mill and pickled free from scale, rust and all foreign matter, leaving the entire surface clean and in perfect condition for surface inspection. Since no reheating of the plate is necessary, the finished product is as free from scale and pits both inside and outside as the plate was after pickling.

The first operation after pickling involves trimming the plate to size by drawing it between two sets of rolls, set up in a fixed position. Thus the longitudinal edges of the plate are prepared for welding and exactly uniform width is insured. This also results in absolute uniformity of circumference throughout its entire length. Obviously the diameter of the pipe, when formed for welding, is also absolutely uniform. When formed, the prepared edges of the plate come together tightly leaving no chance for variation in diameter due to irregular width of welding preparation. The welding of the abutting edges follows.

As this weld is a machine application, a consistently uniform product is assured with little dependence upon the skill or judgment of operators, whose ability to produce perfect results might vary from day to day. After welding come cleaning and inspection operations, which are followed by the final sizing. This is done cold and results in maintaining

†*Field Supt., A. O. Smith Corporation, Milwaukee, Wis.*

size, roundness and straightness, to be obtained in no other way.

The ends are now prepared for field joining in either the ordinary manner for welding or coupling, or for the Smith double bell and stabbing ring or Smith bell and spigot. The Smith method of preparing ends for field welding has resulted in the speeding up of not only line-up and stab, but also of the welding itself. The uniform size and roundness of the ends permits fast and accurate progress, while the introduction of the stabbing or chill ring has made possible better welds in less time than by any of the old methods.

The next step is to test every joint under hydraulic pressure to a stress of 20,000 lbs. per sq. inch. While the pipe is under pressure it is subjected to repeated blows from a series of hammers, the pressure varying with the diameter and wall thickness of the pipe.

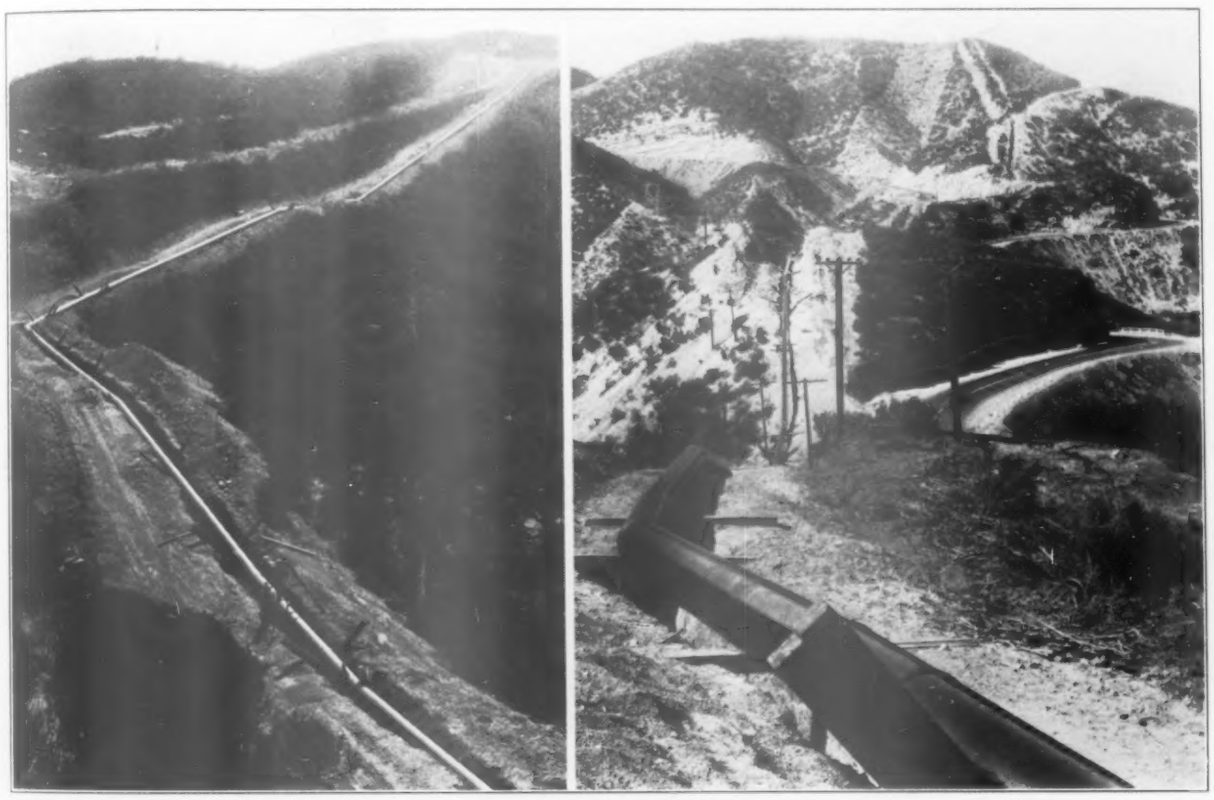
Before applying the shop coat of primer the pipe is washed in a caustic bath and then in a hot water bath, which not only heats the pipe to the proper temperature for priming, but also causes the evaporation of any moisture, which might be left on the pipe after drying.

The pipe is fed through an automatic painting machine, which sprays on a coating sufficient to protect the pipe in transit and until it is ready for the field coat. Since the surface of the pipe is clean and absolutely free from any scale, rust or foreign matter, it permits the paint to bond with the steel, securing an excellent foundation for the field coat. With this protection the cleaning of the line for painting in the field amounts to no more than removing whatever dust and dirt it may have collected while on the ground.

After painting, the pipe is automatically conveyed to the loading dock where again the uniform long lengths and lighter walls have made possible an altogether new and safe method of loading. No pipe has been lost or damaged as a result of any ordinary handling, even with the upwards of 7,000 miles shipped to date.

As greater and greater gas carrying capacities were required, necessitating larger diameter lines running through parts of the country where all manner of weather conditions and temperatures obtained, the constructors of welded lines became fearful of not getting enough slack in the lines through the customary methods of crowding the ditch.

In the smaller diameters it was possible by digging a wide ditch to snake the line from side to side thereby obtaining sufficient slack to compensate for shortening of the line through temperature reversals. This method at best was entirely dependent on some tie-in foreman's judgment, and the number of failures due to tight lines attests to the number of times he has been wrong. Some other method of introducing slack in large diameter welded lines had been sought by the field for some time. The requirement was filled by an expansion joint, developed by Smith engineers.



Two Views of the Terrain Encountered in the Construction of One Interesting Pipe Line.

The Smithweld expansion joint permits the introduction of a certain definite and predetermined amount of slack at those points in the line where slack is required. It eliminates the danger of line failures due to faulty judgment on the part of the pipe layer and offers an insurance against shutdowns due to tight line. The accordion-like construction of this expansion joint makes it very flexible and easily bent cold in any diameter, thus incidentally making it a very desirable bending medium.

As pipe diameters increased, the cost and difficulty of field bends became greater and again Smith engineers came to the rescue by developing a factory bend, which could be furnished for any size and any degree of angularity. These bends are an advantage even in the smaller diameters, since bending the pipe in the field either hot or cold with the tools available cannot help but leave strains in the pipe. This is especially true in fire bends since the uneven heat will cause small areas of the surface to take all the stretch that should have occurred over the entire bend. This condition results in thin spots and consequently a weakened line.

It was at the request of Mr. Lege, President of Magnolia Gas Company, that the Smithweld made its first appearance in the field on pipe line construction. The Magnolia Gas

Company was about to construct 165 miles of 16-in., 18-in., 20-in. all-welded pipe line in northern Louisiana. Having been among the first to construct all-welded gas lines, Mr. Lege and his organization had experienced the need for products and methods, which at that time were not available. They had welded lines up to 16 inches in diameter, and their experience made them reluctant to attempt still larger diameters. Convinced, however, that all-welded construction was most desirable they decided to make another attempt to secure from the manufacturer the product and help they required. As a result, Smith engineers were asked to develop a type of joint which would simplify the line-up and insure a proper preparation for the weld; also, to furnish, if possible, some mechanical means of taking up expansion and contraction in the line, evidenced by movement brought about through temperature reversals, shifting and settling. In answer they devised a belled end and stabbing or chill ring with welding dam to facilitate line-up and welding operations, and an expansion joint to compensate for movements in the line. Their proposition met with immediate approval and work on the project was started. Welders of known ability were picked from the shop organization, gasoline driven generators were mounted on wagons, shipped to the right of way and the unit was ready to work.

After the pipe arrived in the field and construction began, it was found that the new engineering and field methods were of even greater help than had been anticipated. The arrival of the pipe without damage to ends, the stabbing ring with dam, and the accuracy and uniformity of size and roundness made an entirely new operation of the line-up and stab for welding. Less trouble, less expense, greater progress and the use of fewer men resulted. The bell and chill ring with dam offered an ideal uniform welding preparation. The chill at the bottom of the scarf to weld against, insured penetration without danger of icicles. The channel or scarf of uniform shape and width permitted closer stabs and placing weld in tension. Less weld metal had to be deposited and, because of insured penetration, there was no necessity of building up as high as with old methods. Finally, a possibility of roll welding strings 300 to 600 feet long where the right of way permitted, reduced by more than half the number of tie-ins required.

On 20-in. pipe, roll welders regularly produced 30 to 32 welds in nine hours and the bell hole or tie-in welds were completed in 40 to 45 minutes each. Expansion joints placed in the line at intervals relieved the necessity of lowering-in and backfilling only at certain times of the day and made it possible to keep those operations up during regular work hours and in their regular sequence. It was possible also to cut down the width of the ditch as it was no longer necessary to introduce as much slack through "side walloping" as heretofore was considered advisable. Now, after nearly two years of trouble-free operations, these new products and methods have proved themselves superior.

The Smith field organization is made up of men who, in addition to being trained in the application of the Smithweld and the Smith construction methods, have had many years of practical pipe line experience in all parts of the country. They have been present on all major pipe line jobs in the past three years, either as supervisors or as Smith's representatives. This has kept them in touch with the latest development of all construction programs and has put them in a position to utilize and bring together on one job all the short-cuts and expense-reducing ideas developed in the past three years.

The welders are men of known ability picked from a shop organization of several hundred electric welders; men whose jobs for at least a year or more consisted of nothing but welding all day and every day. The A. O. Smith Corporation is probably the only organization having a large enough volume of production welding to support such a great number of men who do nothing but welding.

The present organization consists of enough welders who have the experience of several hundred miles of pipe lines behind them and enough equipment to weld from 22 miles of 10-in. pipe to 17 miles of 20-in pipe in an average nine-hour day. In other words, enough to completely equip from 17 to 22 field gangs, each capable of welding a mile per day.

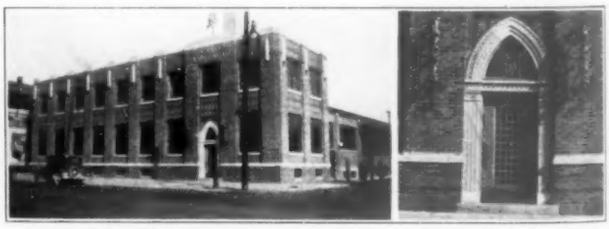
The welding equipment is built up around the requirements of the Smithweld and consists of a six cyclinder, gasoline driven engine direct connected to an electric generator of suitable size. The whole unit is mounted on a special steel frame and wheels supported on roller bearings. Only one arc is supplied from each generator so there can be no variation of current or heat due to arc interference. The experience gained in welding nearly 2,000 miles of large diameter pipe in all manner of weather and right of way conditions has produced a piece of field welding equipment which gives uninterrupted service day after day while in the field. In each gang a competent mechanic is furnished to maintain and care for the equipment and at the end of each job all wearing parts are replaced insuring the start of each new job with the equivalent of new equipment.

Each gang is directly in charge of a competent field foreman and where more than one gang is working on a line a general foreman is placed in charge to insure coordination of all gangs. The number of generators required per gang is determined by the progress requirements, the size of pipe and the type of country the line traverses.

Assuming an average condition of right of way, an eight generator gang consisting of foreman, mechanic and nine welders (one spare man) will produce an average of 220, 10 in. weld, or 175, 16-in. welds, or 132, 20-in. welds, or 110, 24-in. welds per nine hour day. The possibility in good, level right of way is 30% greater, but these figures present a conservative average.

INDIANA OXYGEN COMPANY NOW SETTLED IN NEW BUILDING

In 1915 the Brant Brothers—J. R. and W. L. Brant—formed the Indiana Oxygen Company in Indianapolis, Ind., for the manufacture of oxygen and acetylene gases. Having outgrown the original plant, a new factory and office building was erected last year, the work being completed in the Fall of 1930. The illustration shows the outside appearance of the new building which embodies modern features of factory construction as well as containing up-to-date machinery



The Attractive Appearance of this Oxygen Plant Suggests Modernity and Efficiency.

for the manufacture of oxygen, hydrogen and nitrogen gases. In addition to this plant, the Indiana Oxygen Company owns and operates a large modern compressed acetylene plant which is located at Beech Grove, Indiana. They also act as jobbers and distributors for welding and cutting apparatus, welding supplies, carbide, etc. In the illustration there is shown at the right a close-up of the entrance to the new plant. The decorative lighting fixtures at either side of the door-way were made by cutting gas cylinders with the cutting torch.

Hints for the Welder

WHEN YOU FIND a new way to do a hard job, or finish a particularly interesting weld, can you describe how the work was done? . . . . . Have you learned some little stunt every welder ought to know? . . . . . Write to us about these things . . . . . This department helps you welders to help each other. Write up your ideas any old way and just make rough pencil sketches . . . . We'll fix them up for publication.

BUTT WELDING TEETH ONTO BAND SAW

By R. C. Leibe

The thousands of lumber mills and wood-working plants throughout the country are great users of band saws; and each plant—large or small—has considerable replacement and repair expense caused by accidents to the saws, such as cutting into iron or into large nails, which plays havoc with the saw teeth. These saws generally range in size from 20 to 14 gage, and such thin steel is easily broken.

The knocking out of four to six teeth in a row means a considerable loss, and heretofore the repair has been made by one of two methods. One method is to grind the entire saw down to bring up the stubs into new formed teeth, which

FIG. 1

means a loss in saw width often of ⅜ to ½ in.; this is equivalent to at least a six months' decrease in the life of the saw. The second method is to cut out the damaged saw section, thus shortening the saw and requiring the addition of another braze, each reducing the saw's capacity and length of life. Many saw men consider that either method of repair lowers the efficiency of the saw by 30% and reduces its life by as much.

The writer recently developed another method of repair which meets all requirements and is quickly affected, and at the same time it does not have the disadvantage of reducing the life or efficiency of the saw. This new metnod requires the use of an oxy-acetylene welding torch, and opens up a new and promising field for oxy-acetylene equipment in the saw-fitting departments of mills and repair shops.

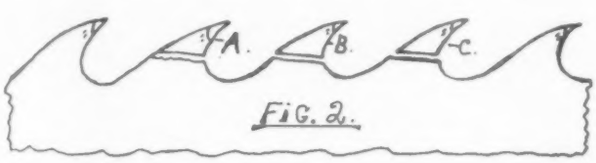


FIG. 2.

By the new method, which was recently used in the repair of a band saw in which the teeth had been ripped out for a distance of 7 in., consists of cutting out extra teeth from an old saw blade and butt welding these teeth onto the stubs of the broken-out teeth. This was done in such a way that there was no warping or loss of temper in the steel.

The procedure entails placing the blade of the saw, where it needs repairing, onto a hammering cast-iron block with the new teeth placed in their proper locations, abutting the stubs of the broken teeth. Then a heavy steel-faced anvil is placed on top of the saw, with the broken stubs just visible. This arrangement prevents undue heating of the body of the saw when the welding torch is applied.

The torch is fitted with the smallest welding tip available. The stubs and the new teeth are heated and run together and reinforced at the joint with mild-steel welding rod to a thickness a trifle greater than that of the saw. The saw is then turned over and placed in a like position with respect to the block and anvil, and this side of the joints are run together and built up in a like manner. When the welded teeth are cool, they are dressed with a file and a

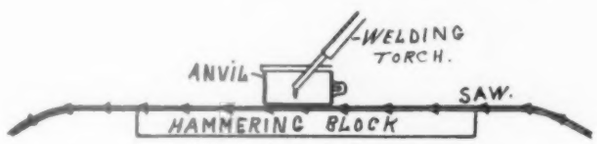


FIG. 3.

portable grinding wheel to the correct thickness, and the teeth are then shaped and fitted ready for use. The saw is giving good service; and the welded teeth cannot be told from any of the original teeth, so perfect and successful was the job. Moreover, the repair was accomplished in a very short time.

In the illustration, the top diagram shows the section of the saw containing the missing teeth, the center diagram illustrates the teeth cut from a discarded saw and ready to be welded onto the stubs, and the lower diagram shows the saw in place on the cast-iron block, with the anvil on top, and the welding torch in position to make the weld.

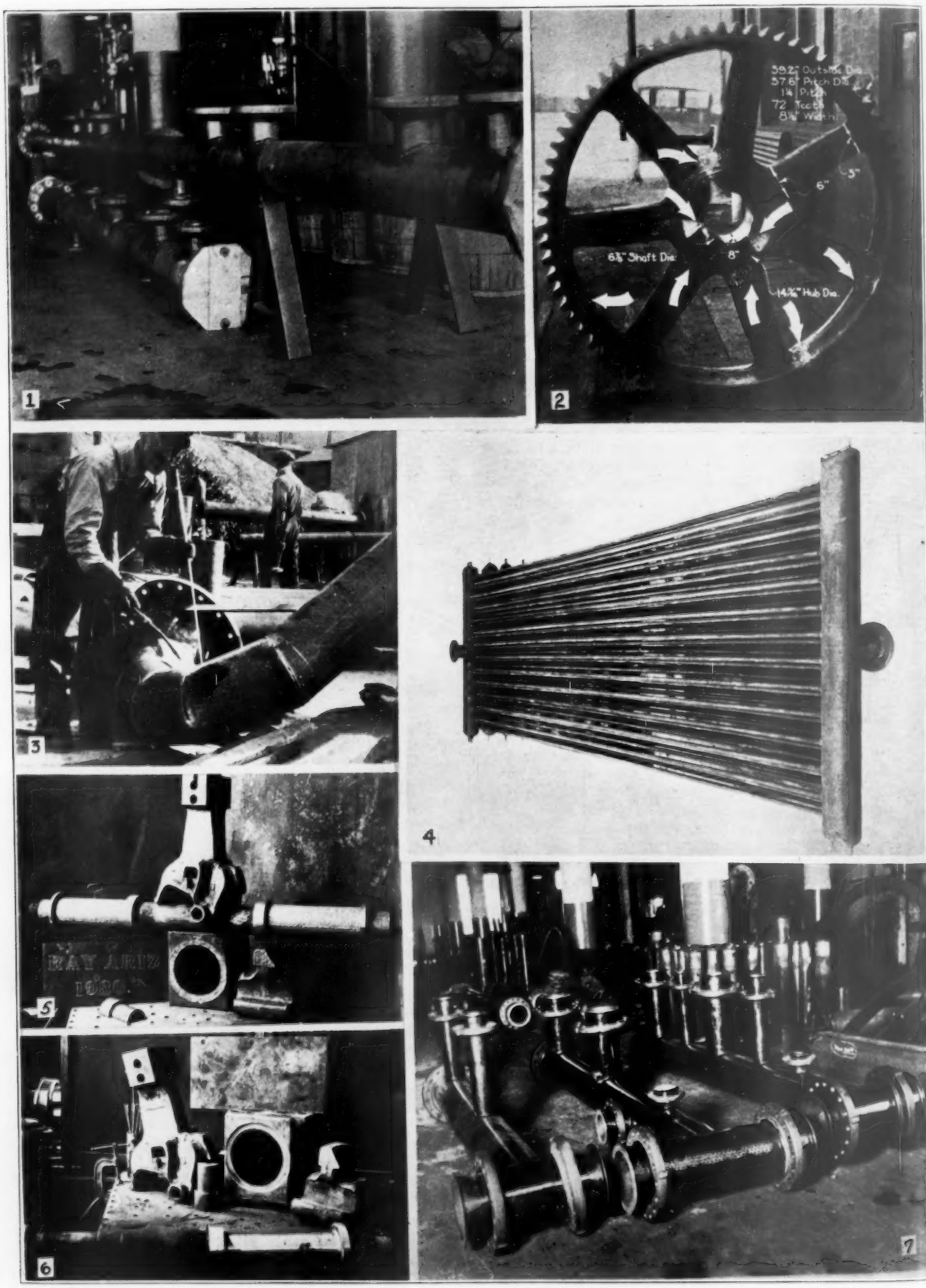
HARD SURFACING PUMP PLUNGERS

By O. H. Barnhill

A high pump efficiency with almost complete elimination of piston wear has been obtained by R. G. Le Tourneau, of Stockton, Calif., manufacturer of welded earth-moving machinery, by electrically fusing onto the plungers a layer of Stoodite.

The pump thus improved is a 100-g.p.m. Domestic Giant powered with a 35-hp. Continental gas engine. The 4-in. pistons make eighty 8-in. strokes per minute against 300-lb. pressure, elevating water 400 ft. and pushing it two miles through 3-in. iron pipe from Bear Creek to the head of Salt Creek. The water thus raised is used to moisten 6 miles of a grade being built by Le Tourneau as the first section of the new Williams-Ukiah highway in Colusa County, California.

Creek water always contains more or less sand or other grit, which becomes embedded in pump packing-glands and wears off the smooth surface of the plungers, causing leakage, loss of power, and decreased efficiency. Certain mate-



A Variety of Welded Jobs from Western Shops—See Opposite Page for Descriptions.

rials are practically impervious to such wear, therefore pistons coated with such alloys remain perfectly smooth and retain their exact cylindrical shape.

An attempt to face the surface of a hollow piston with Stoodite proved unsuccessful, because of the shrinkage from welding heat. Larger tubes might have been substituted, if the amount of shrinkage could have been accurately determined and if the contraction had been uniform on all parts of the plunger. Shrinkage, however, was less at the outer end of the piston, which cooled more quickly, leaving the plunger of uneven diameter.

Round bars of solid steel therefore were substituted. These were turned to a diameter ¼ in. less than that of the 4-in.-diameter chambers in which they were to work, leaving space for a ⅛-in. layer of Stoodite on all sides of the pistons.

Electric heat was used for welding on the extra-hard metal, because it is quicker and produces less expansion, thus reducing any danger of cracking the fused metal. A 200-amp. G-E welding machine and ¼-in. electrodes were employed.

Uniform expansion of the piston was obtained by heating it cherry-red in an improvised furnace made of firebrick and equipped with a portable burner using atomized fuel-oil. The Stoodite was deposited in ¼-in. beads, ¼ in. thick, lengthwise with the piston. Smoothing the uneven surface of the fused layer reduced its thickness one-half, leaving it ⅛ in. on all sides of the base metal.

Grinding the hard-facing layer down to uniform thickness proved a difficult operation, owing to its high degree of hardness. Using a large carborundum wheel adapted to other hard bearing metal, the Geiger Iron Works, of Stockton, ground one of the pistons for 20 hr. before it was reduced to proper proportions. Minute particles of the hard material became imbedded in the grinding wheel, thus glazing the wheel's surface. More of these particles were deposited in some places than others; therefore the surface of the grinding disk became uneven, losing its perfect round. The result was a varying pressure on the wheel's bearings, which became worn and out-of-true.

Grinding difficulties were overcome by obtaining a 1946-grain Norton Alundun wheel of Grade K hardness, 26 in. in diameter, with a 1½-in. face and 12-in. counterbore. In addition to being very hard, this particular wheel is quite coarse-grained; therefore it will not glaze over, since abraded particles of Stoodite are too small to find lodgment in such porus material.

The grinding time was cut in half, being reduced from 20 hr. to 10 hr. per plunger. In addition to this substantial time saving, the grinding machine's bearings were uninjured by the work.

The amount of Stoodite used on each piston was about 8 lb., the shell being 8x4x¼ in.

Although Stooditing pump plungers is somewhat expensive, Le Tourneau is convinced by results attained that the outlay was amply justified. The improved plunger is in perfect condition, after four months, 24 hr. per day, of the hardest kind of use, and is expected to retain its high efficiency indefinitely.

A VARIETY OF WELDED JOBS FROM WESTERN SHOPS

The illustrations displayed on the following page were entered in the photographic prize contest conducted several months ago by the Stoody Company, of Whittier, Calif. Other interesting photographs entered in this contest were shown and descriptions given in the September and December issues of *The Welding Engineer*.

Fig. 1 shows a 10-in. welded header, with branches and flanges also welded. These are 800-lb. test branches, of sizes 3, 4 and 6 in. The oxy-acetylene process was used. This header was made for C. C. Moore, engineers, by the Crane Company shops, and the photograph was submitted by Jack Sylva, of San Francisco.

Fig. 2 shows the main gear on the 3-in. Ajax forging machine in the Southern Pacific shops at Ogden, Utah, used to supply the Salt Lake Division with all bolts and forgings up to 3 in. in diameter. This gear was welded at the places shown by the large arrows, at a cost of $106.16, and the machine was out of operation for seven days. A new gear costs $180.61, and to have ordered and installed a new gear would have required the machine to be out of service three to four weeks. Since the gear was welding in April, 1929, it has been in continuous operation. This photograph was entered by James P. Gale, of Ogden, Utah, and was awarded second prize in the Class 2 entries.

The welding of a 130-deg. return ell, from 10 to 16 in., is shown in Fig. 3. The welding was done by Paul E. Smith, of Compton, Calif., who submitted the photograph. The ell was built for the Shell Oil Co.

Fig. 4 is an unretouched photograph of a Campbell Cool-R-Unit, for cooling water, oil, gas, and gasoline. This unit is electric welded throughout. Owing to the bringing together of unequal surfaces, a job of this sort is subjected to considerable strain, and for that reason arc welding was deemed the most suitable. This photograph was submitted by Lewis E. Campbell, of Long Beach, Calif., and was awarded second prize among the Class 3 entries.

Fig. 5 illustrates a group of worn articles built up by electric welding, and Fig. 6 shows the same articles before welding. At the top in Fig. 5 is a freight-car coupler, worn in contact with the carry iron. This coupler is resting on a skip shaft built up to turn to size, underneath which are a coupler knuckle and a freight-car oil box showing the wheel side built up. The small piece lying near the oil box is one-half of a tool die. The plate on the left shows "a little near-artistic effort of mine," says Refugio G. Flores, of Sonora, Ariz., who entered the pictures. These articles were welded for the Nevada Consolidated Copper Co., of Ray, Ariz., and the photographs were awarded first prize among the Class 3 entries in the contest.

Another entry by Jack Sylva is that designated as Fig. 7, which shows electric-welded 10-in. wrought-iron pipe headers, for regulators and meters, made for the Coast Counties Gas Co., by the Crane Company. The welding time was 17 hours. Eighteen pounds of ⅝-in. rod, 75 cu. ft. of acetylene and 20 cu. ft. of oxygen were consumed. The branch sizes are 4, 6 and 8 in., and the working pressure is 450 lb.

NEW ARC WELDED FACTORY IN STOCKTON, CALIF.

R. G. Le Tourneau, Stockton, Calif., with the assistance of his Chief Engineer, Frederic Hosie, has designed and built a splendid new plant incorporating several new ideas in welded building construction.

The new plant is 60 feet wide, 300 feet long, and 22 feet to the eaves. The outside steel posts are welded to steel plates anchored in the foundation and the sheeting is 20-gauge corrugated black iron. These sheets are put on lengthwise in place of the conventional vertical method and are securely welded, forming all the bracing necessary for the building.

There are 24 large windows, 10 feet by 14 feet, each consisting of 24 panes of 26 by 28 glass. The frames and cross frames are all of welded steel T-iron.

The doors are approximately 16 by 20 of the same construction as the building with I-beam frame and sheet metal bracing. The roof trusses and purlins with the sheeting form a very rigid section which help to strengthen against wind pressure. The purlins are 3-inch I-beams welded to the rafters. The sheeting is welded to the purlins. The sides and posts are welded to the roof, making the building one piece of steel. It is designed to stand a wind pressure of

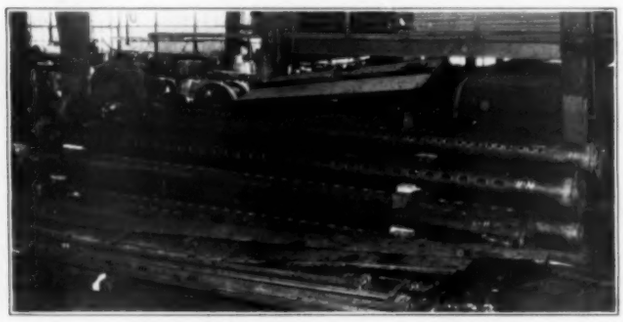
20 pounds per square foot. The roof trusses, of which there are 16, will each support a load of 40,000 pounds, which is a load of approximately 33 pounds per square foot of roof area. The building is thought to be the only one of its kind in United States, being completely electrically welded even to the extent that all of the lighting fixtures are welded.

In the building there is a 20-ton crane operated by motors. It is made of 10-inch by 26-inch heavy welded box beams 60 feet long. The crane runs the entire length of the building on rails at each side. The rails are welded to the posts 17 feet above the floor. These crane rails are additional bracing for the building. The rails are welded at the joints, forming one continuous beam of 300 feet on each side. The rails are 8-inch I-beam and 20-pound ASCE rail welded together. There are 15 additional posts on each side to support this rail. They are anchored to the concrete in the same manner as the truss support post, and are welded to the lower purlin.

There is a spur track running into the building for the unloading of steel from cars and loading out of road making equipment. The large door admit the train with ease. The offices and drafting room are built in one corner of the building.

WELDED HEADERS FOR POWER BOILERS

A number of large water-tube boilers of the Lasker-Adams type have been erected for the Sewerage and Water Board of New Orleans, La. The tubes forming the "water walls" of



Boiler Headers With Welded Flanges and Heads.

these furnaces terminate in headers located outside the refractory walls, where they are not subjected to the intense heat of the furnace gases and flames. These headers are equipped with welded-on flanges and heads. A group of these headers is shown in the illustration in the plant of the Lasker Boiler & Engineering Corp., at 3201 Lincoln Ave., Chicago, who are manufacturers of the boilers.

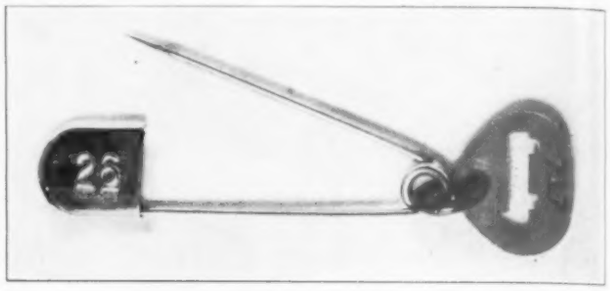
LAUNDRY CHECK IS ARC WELDED

A unique application of the electric arc welding process, and one which has not only been a means of giving greater strength to a product, but also a means of fabricating this product in an entirely new way is shown in the accompanying illustration.

This photograph shows a key tag check for use in power laundries. It consists of a check and pin, joined by a small ring. It is this ring that is being welded, as may be seen in the photograph. These checks are produced in a variety of sizes so as to care for different sizes of bundles in their course through the laundry. This system is manufactured by The Key Tag Checking System Company of Cleveland, Ohio.

The purpose of this checking system is to eliminate "shorts" and "overs" in laundries. This is done by keying the checks and numbering them so that in assembling the work of a customer the various bundles have the same number and consequently the same check, thus avoiding any interchange of bundles. These checks fit over an arm so that in sorting only the check with a number corresponding to the number and keyed the same as the arm can be hung on the arm.

The arc welding process is utilized for sealing of the rings which join the checks and pins. The former method was to compress the ring and close it by butting the ends to-

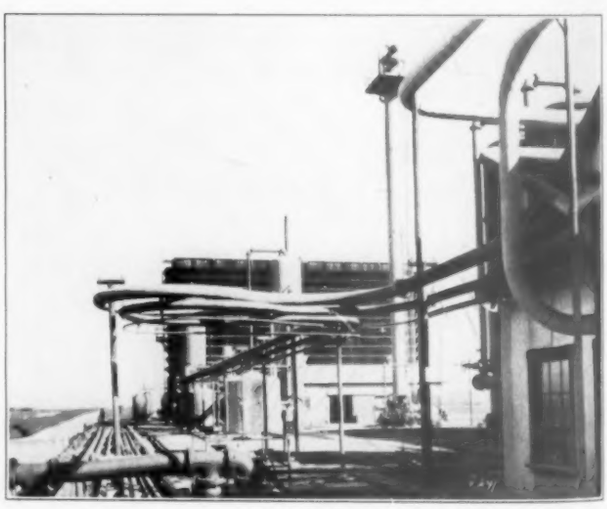


Arc Welding Makes the Bronze Ring a Permanent Job.

gether. It was found, however, that the ring pulled apart and the pin and check became separated. These rings are made of phosphor-bronze in order to prevent rusting. By use of arc welding it is possible to flow the ring into a continuous circle, thus increasing its strength. The ring is made of 8 gauge phosphor bronze wire and is flowed together with a $\frac{3}{32}$ inch carbon electrode. .A "Stable Arc" welder, manufactured by The Lincoln Electric Company, Cleveland, Ohio, is used to weld these rings. Approximately 800 per hour are sealed by this process.

WELDING IN OIL REFINERY CONSTRUCTION

The accompanying photograph is a view of a portion of the refining plant of the Del Rey Oil & Refining Company, located in the Venice oil field of southern California. It shows very clearly some of the applications of welding and the way welding solves some of the problems of refinery construction. Many of the major oil companies are adopting welding more and more in the erection and maintenance of their plants with marked economy and efficiency.



Tube Turns Are Used to Good Advantage Here.

Note in this picture the use of welded pipe in making graduated turns. Also a unique and practical method of taking care of the expansion and contraction in the steam lines running to the distillation and pump house, is shown by the large loops or horseshoe bends. This work is all handled by acetylene process.

Tube Turns are also welded in to make graduated turns in a number of installations of this nature.

GEORGIA TECH. HOLDS FIRST WELDING CONFERENCE

The first of what is expected to be a series of annual conferences on welding was held at Georgia School of Technology, Atlanta, Georgia, on February 5th and 6th under the direction of the Mechanical Engineering Department. The purpose of the conference was to bring together at the school a group of men interested in the latest developments and possibilities of welding in its various forms. Special demonstrations were arranged following each session, and equipment and materials were exhibited in the welding laboratory in the Mechanical Engineering Building.

Following is copy of the program of lectures:

Thursday, February 5

Address of Welcome—M. L. Brittain, President, Georgia School of Technology.

Problems we have Encountered in the Welding Field—George Bird, Jr., Secretary Bird-Potts Co.—Welding Engineers.

Education in the Welding Field as given at the Georgia School of Technology—O. M. Harrelson, Instructor, Welding Laboratories, Georgia School of Technology.

Welding with the Shielded Arc—J. E. Durstine, Engineer with the Lincoln Electric Co., Cleveland, Ohio.

Address by Lewis Gordon, Manager, Southern Power Journal.

Popular Lecture and Demonstrations on Liquid Air and Its Applications—G. E. Harcke and J. H. Callahan, Engineers Air Reduction Sales Co., New York City.

Friday, February 6

Oxwelding Industrial Piping—H. E. Rockefeller, Engineer, Linde Air Products Company, New York City.

The Electric Welded Joint in Structural Work—R. W. Van Kirk, Engineer, General Electric Company, Schenectady, N. Y.

General Characteristics of Copper and Copper Alloy Welding Rods—Ira T. Hook, Test Engineer, American Brass Company, Waterbury, Conn.

Automatic Electric Welding—T. P. Kirkpatrick, Engineer, Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa.

Cutting Steel Shapes with Oxy-acetylene Machine Torch—F. E. Rogers, Engineer, Air Reduction Sales Company, New York City.

Hard Surfacing—R. W. Boggs, Engineer, Linde Air Products Company, New York City.

G. P. A. CONVENTION DRAMATIZES SALESMANSHIP

At the Seventeenth Annual Mid-Winter Convention of the Gas Products' Association at the Sherman House, Chicago, January 27th and 28th, sales methods were the main topics for discussion. The subject of industrial selling was treated from a number of important viewpoints, and the high-lights of the art of salesmanship were presented in a way which would make interesting and valuable reading for any sales manager who was faced with the problem of building a sales volume for industrial products.

The meeting was opened Tuesday morning by Gerald E. Stedman's talk on "More Bulwark, Less Bullwork." After calling attention to the changed market conditions the executive must meet today, he warned against six specific pitfalls which he called Volume Madness, Lack of Concentration on Profitable Items, Failure to coordinate between Office and Salesmen, Failure to Know the Market, Failure to Know Competition, and Lack of Straight Line Projection or of a well-planned policy. In each instance he suggested how the trouble could be avoided and followed this with a constructive, scientific sales plan which could be profitably adopted in its essentials by any member of the Association. This included geographical market selection, building up of profitable accounts only, interest in merchandising of your product through to the ultimate consumer, securing of profits through budget control, and the education of salesmen, office and distributors along a specific sales promotion plan; thereby securing sales continuity.

Left: The Well Informed Salesman Gets Attention, Interest and Orders. Right: The Bluffer Fails to Impress Men Who Know Their Stuff.

President Ellsworth L. Mills, who is sales Manager for the Bastian-Blessing Company, Chicago, outlined seven fundamentals necessary to winning a sale, briefly described as "Don't try to do all the talking yourself—" "Don't interrupt the speaker"—"Avoid a belligerent attitude."—"First inquire rather than attack"—"Re-state in your own language each point raised by prospect"—"Identify one key issue and stick to it" and "Know your Line." Following President Mills' remarks these seven sales fundamentals were illustrated by the presentation of actual sales interviews. A stock company composed partly of professional talent and partly of talent drawn from the Association staged four "Selling" acts which had been written especially for the event by Earl M. Evleth, Counselor, with the assistance of Members of the Program Committee. Each of these acts showed a prospective customer in the market for a sizeable order of merchandise and in each case two different salesmen attempted to get the order. In each case, also, the order was

obtained by good salesmanship. Between acts Mr. Stedman pointed out the selling mistakes made by the man who was unsuccessful and also showed how the salesman who captured the order had done so by observing some of the seven principles of salesmanship which had been explained in the morning lecture. These sales incidents were interspersed with local color and humor which maintained interest at a high point, even though the serious matter of getting the business was under discussion.

At the morning session on Wednesday, January 28th, Mr. A. J. Fausek, President of the Modern Engineering Company, opened with a lecture explaining how the sale of welding and cutting equipment paves the way for increased sales of oxygen and acetylene gases. His paper was followed by a paper on direct mail advertising which was delivered by Mr. Homer J. Buckley of Buckley, Dement & Company, Chicago. Mr. Buckley is nationally known as an authority on mail advertising and also on merchandising problems. He started out by proving that unsupported personal selling of industrial products results in high sales losses and prohibitive selling costs. To offset this condition, he pointed out that the operation of a sales promotional plan as a selling support and as a basis of sales direction is the first step in the establishment of the efficient sales coverage of industrial markets. Mr. Buckley then emphasized the constant changes that are taking place in merchandising efforts which is shown so graphically by the fact that specialty salesmen of today are selling comfort, convenience and entertainment rather than the products which they deliver to provide these things. Manufacturers who are selling to industry today must adopt similar sales methods if they are to be successful. In fact, industrial salesmen today are selling something more than machinery—they are selling lower production costs, less waste, better quality production and bigger production. Mr. Buckley pointed out that the industrial advertisers who are talking to themselves instead of to their prospects are lagging behind—that they must wake up to the fact that industrial advertising today is something vastly more than a mere description of the product and a listing of the specifications—that it involves a knowledge of all the industries in which that product is used and a broad understanding of industry in general. He advocated the consistent use of direct advertising to present the right sort of sales information to the right people, and at the same time emphasized the necessity for the most careful study of the market.

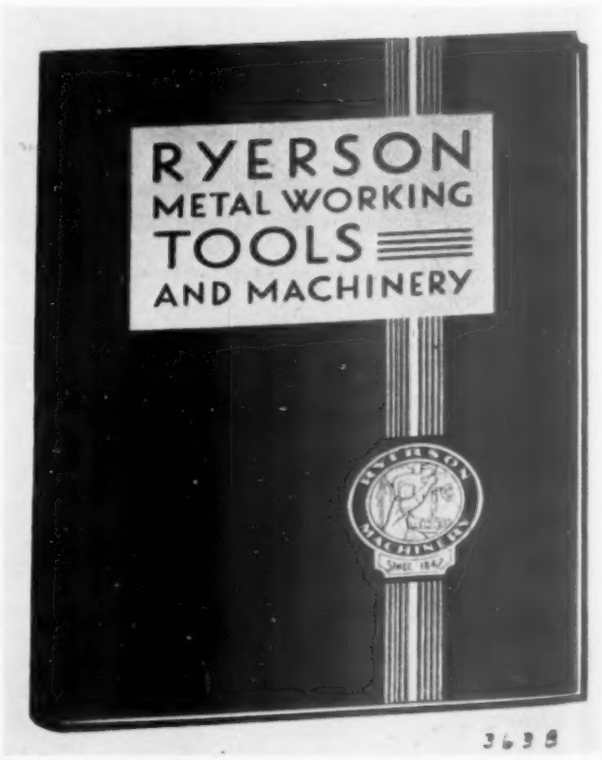
In the afternoon session on Wednesday, Mr. Lloyd T. Keenan of Webb-Linn-Page, Inc., Chicago, talked on the subject "The Foundation of Successful Direct Mail Advertising." In this talk Mr. Keenan considered the essential element of the direct mail advertising program, which is known as the mailing list, and showed that the care with which the mailing list is prepared determines the effect of all sales promotional effort. By selecting a list of many of the important industries who are logical users of the welding and cutting processes and showing how many firms were engaged in those various lines of business, Mr. Keenan furnished an excellent presentation of how prohibitive would be the cost of attempting to reach all of the people engaged in all of these industries. Then, by means of actual experiences, he showed how rapidly a mailing list can decrease in usefulness and value, even though it might have been prepared originally with the greatest care. It is this failure to take the proper care of the list of names which accounts for so many disappointments in sales promotional campaigns. In fact, there is so much opportunity for large scale waste in a poorly maintained list that the list itself deserves the constant attention of a responsible executive. Mr. Keenan pointed out the value of a good mailing list to the salesman in the territory and indicated that if the salesmen themselves were kept well informed on the value of sales promotional work to them, that they would not hesitate to give their full cooperation toward keeping the mailing lists in first-class condition.

"How to Sell Welded Pipe Installations" was the subject of the paper presented at this session by Mr. A. L. Byfield of Himelblau, Agazim & Company. This firm has produced welded pipe assemblies for scores of buildings in the Chicago district. Mr. Byfield has many times cooperated with builders and contractors, showing them how to reduce installation costs and get a better piping system by using welding instead of mechanical fittings. He gave an excellent presentation of the advantages of the welded installation and showed by sketches what a simple matter it is to alter the drawings on any particular job so as to change a fitted installation to a welded one.

The final paper of the afternoon session, entitled "Welding Clinics" by H. S. Card, Editor of THE WELDING ENGINEER, consisted of a detailed description of methods followed in starting, operating and following up a short course of welding instruction.

The Convention closed with a splendid banquet held in the Sherman Hotel. The banquet was well attended and the usual good time was enjoyed by all the members. Altogether this Convention held the interest and attention of the members from start to finish. The successful execution of this elaborate and well conducted program reflects considerable credit on Ellsworth L. Mills of the Bastian-Blessing Company, who is president of the Gas Products Association, and the Program Committee, who attended faithfully to carry out all the details.

NEW RYERSON TOOL AND EQUIPMENT CATALOG



The New Ryerson Tool and Equipment Catalog.

A unique catalog published recently by Joseph T. Ryerson & Son, Inc., includes practically every type of tool and portable machinery used in the metal working field. All supplies are omitted, the book being devoted entirely to equipment for manufacturers, job shops and contractors.

The following brief list will give an idea of the diversified line illustrated and described:

General Equipment:

Electric Tools including Drills and Grinders.

Pneumatic Tools of all Types.
Hoisting Equipment including Hand Operated, Air and Electric Hoists; Trolleys, Small Cranes, Trucks and Jacks.
Small Tools such as Drills, Taps, Dies, Reamers, Wrenches, Files and Hack Saw Blades.
Shop Furniture including Benders, Bench Legs, Stools and Trucks.

For the Machine Shop:
Bench Lathes, Drills, Milling Machine Presses, etc. Accessories including Vises, Chucks and Lathe Tools.
Small Tools of every description.

For the Sheet Metal or Tin Shop:
Everything required for working sheet metal, including:

Brakes	Snips and Stakes
Folders	Punches
Rolls	Rotary Machines
Shears	Groovers

For the Structural, Boiler or Blacksmith Shop and Contractor:
Forges and Furnaces.
Anvils and Anvil Tools.
Welding Equipment and Accessories.
Punches, Shears and Benders.
Erection Tools, including Fitting-up Wrenches, Drift Pins, Dollies, Air Guns and Rivet Sets.
Air Compressors and complete line of Pneumatic Tools.

All of this material has been condensed into a single volume of 158 pages, a convenient size for reference purposes. The book was published primarily for the convenience of small tool and machinery buyers, but the Ryerson Co. reports that a number of universities have requested copies for use in connection with their technical courses.

"OXY-ACETYLENE TIPS" APPEARS IN NEW SIZE

Linde Air Products Company, New York City, have started the publication of their house organ "Oxy-Acetylene Tips" in the standard magazine size, having a 7"x10" type page. With this changed, the method of illustration has been changed so that larger pictures can be used and the attractiveness of the display of illustrations is considerably increased. The January issue contains a splendid article on the Development of Oxwelding and Cutting. This is a brief history of the accomplishments in gas welding from the earliest days of the process down to the present. Additional articles describe the use of welding in the construction of headers, welding as used in the construction of a metal base highway, in ornamental iron work, in repairing road machinery, and mill equipment..

DIRECTORY OF RESEARCH LABORATORIES ISSUED BY NATIONAL RESEARCH COUNCIL

The National Research Council, Washington, D. C., has recently published a list of industrial research laboratories of the United States in the form of a 270-page book. This book contains an alphabetical list of over 1,600 laboratories, a list of more than 1,900 research directors, a geographical index and a subject index. In the alphabetical list of laboratories there is a great deal of detailed information regarding the personnel of many of the laboratories and also regarding the particular activities which engage most of their attention. At the end of the book there is a subject classification so that the reader can easily pick out those laboratories which are working on particular subjects. According to this index there are fifty-five research laboratories which devote some of their attention to welding subjects. The book is bound in paper and is obtainable from the Publication Office of the National Research Council, Washington, D. C., at $2.00 per copy.

NEW REPUBLIC BOOKLET ON ARC WELDING STAINLESS STEELS

The Central Alloy Division of the Republic Steel Corporation, Massillon, Ohio, has recently published a twelve-page booklet on the "Arc Welding of Stainless Alloys" which may well serve the double purpose of an information bulletin and instruction manual. It lists and describes the various corrosion resisting alloys made by the Central Alloy Division and gives a complete discussion of the weldability of different types of alloys. It also outlines carefully the proper procedure to follow when arc welding them. The booklet is well illustrated with photographs of welds and microphotographs of sections and also pictures illustrating various tests which have been made on welded specimens and some examples of stainless steel articles fabricated by welding.

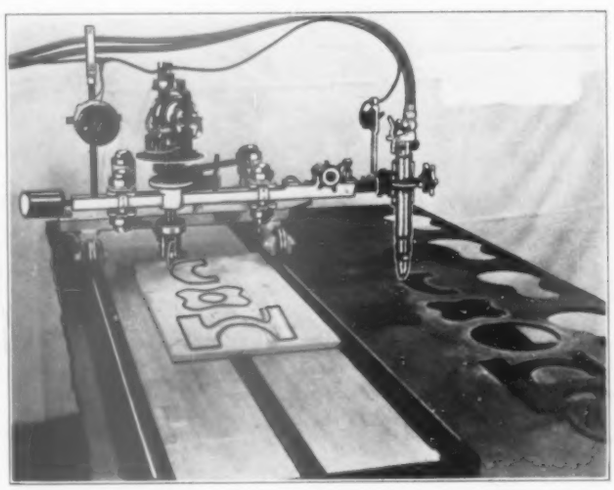
SMITH BOOKLET ON GAS LINE CONSTRUCTION

Bulletin No. 510 recently published by the A. O. Smith Corporation, Milwaukee, Wisconsin, entitled "The New Way of Designing and Building Gas Lines with Smith Welded Pipe" is a 52-page booklet full of interesting data on pipe line construction. The first section is a treatise on the factors effecting a minimum cost of gas pipe lines. Many tables and charts are used to help the estimator arrive at pipe line costs for various combinations of pressure, volume, and dimensions. The second portion of the book is a well illustrated paper on the subject of pipe line welding, which describes the materials and procedure used by the A. O. Smith Corporation in building a number of important transcontinental lines. The booklet concludes with a collection of charts and tables giving engineering data on the pipe manufactured in the Smith factory.

NEW BULLETIN OF KORO PRODUCTS

The Koro Corporation, Bellwood, Illinois, just published a new bulletin containing descriptions of the complete line of Koro welding rods and wires. The information is so arranged as to serve the purpose of a chart for the selection of welding materials to use for different classes of work. Several new Koro wires, recently developed and not previously listed in their catalogue, are described in this new bulletin.

A NEW PORTABLE AUTOMATIC SHAPE CUTTER



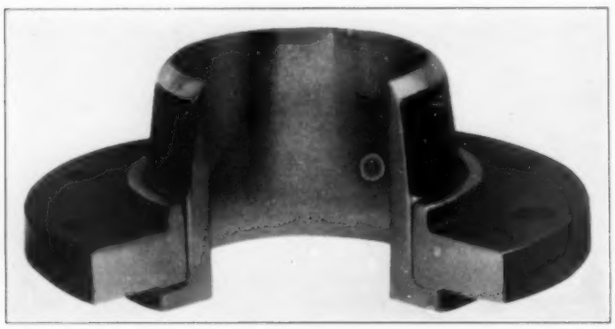
Type K-O Automatic Shape Cutter.

A new portable automatic shape cutter, type KO, has recently been put on the market by the General Welding & Equipment Company, Boston, Mass. It is particularly designed for the production of large quantities of narrow

shapes where the portable machine can be set directly on full size plates. It is claimed that this machine handles exceptionally large work with ease and that any size of machine body can be cut with it. A descriptive bulletin has been prepared which includes illustrations of this new cutting machine at work on several varieties of cutting operations.

THE MERCO SWIVEL FLANGE

The Merco Nordstrom Valve Company, 343 Sansome Street, San Francisco, Calif., have recently announced a line of swivel flanges marketed under the trade name of Merco. Their announcement states that these are forged steel flanges which have been developed for use in welded piping, combining the advantages of the lap joint with the loose flange. The nipple is drop forged from a solid billet and shaped to give a cross section greater than the pipe thickness adjacent to the lap, this being indicated as the region of greatest stress under service conditions. It is stated that the lap

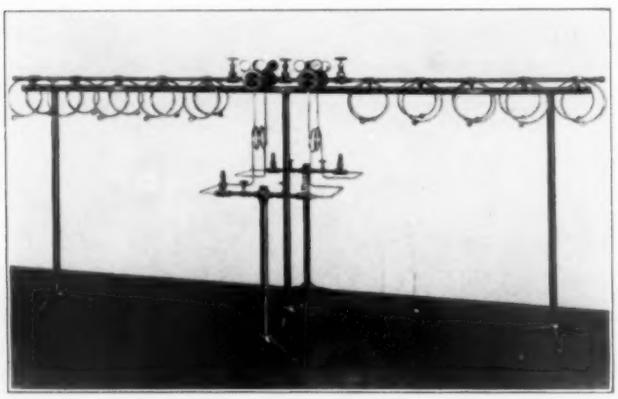


Merco Swivel Pipe Flange.

may be forged to any required thickness and is in all cases much heavier than the pipe thickness. These flanges are adapted to the requirements of the petroleum, gas, steam power and chemical industries of welded piping in general. They come in a large variety of sizes for both standard and extra strong pipe.

MILBURN 20-TANK MANIFOLD

The Alexander Milburn Company, Baltimore, Maryland, manufacturers of cutting and welding equipment, portable carbide lights and paint spray apparatus, are manufacturing 20-tank manifolds as illustrated below.



New Milburn Manifold.

These manifolds are constructed of bronze tubing, Milburn standard gas regulators and copper coils; mounted on a sturdy tripod they serve as a central source of supply for cutting and welding torches. They are used to eliminate the necessity of transporting cylinders about the plant.

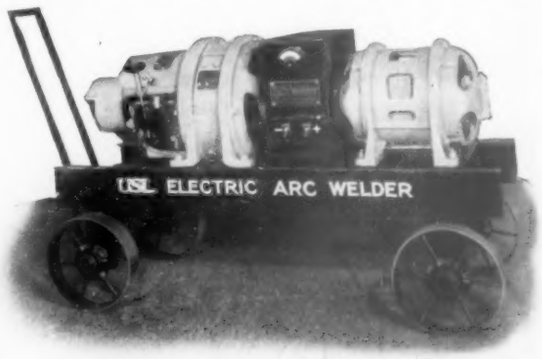
A feature of the Milburn manifold is that if desired each tank or each side of the manifold may be operated independently through separate shut off valves thus allowing the torches to continue in operation while the tanks are being connected or disconnected.

MUELLER BRASS FEATURES STREAM LINE PIPING

Mueller Brass Company, Port Huron, Michigan, has issued a number of attractive bulletins describing the uses of their line of "stream line" fittings for copper piping. The method of making a connection with these fittings is by soldering, using a special solder. The fitting is placed on the tube or pipe where required, and after the solder paste or flux has been applied, it is heated uniformly with a torch and the solder is fed in at openings in the fitting which are left for that purpose. This class of work can be done with the ordinary plumber's blow-torch, but in a good many cases, the large dirty flame of the blow-torch is objectionable. The use of these fittings therefore seems to offer an opportunity for using a small oxy-acetylene or air-acetylene torch, the tiny flame having its effect confined entirely to the piping and furnishing an intense heat which will do this job in a minimum amount of time.

NEW USL WELDER HAS NO VOLTAGE ADJUSTMENTS

The arc welder division of USL Battery Corporation, Niagara Falls, New York, has just put on the market a new type of electric arc welding machine to which they have given the trade name "Full Range." This name is used to indicate that on account of its special construction an infinite number of accurate welding current adjustments may be made. There are no voltage adjustments of any kind and no switches or rheostats for current adjustment. Instead, there is an adjusting device operated by a small hand-wheel called an "Electrode Indicator." This indicator is set by the operator for the size electrode being used, and the machine is then ready for the welding job. The advantage claimed in the use of this Electrode Indicator is that it permits an infinite number of accurate current adjustments, as mentioned above, and assures proper welding characteristics for every size electrode. It also eliminates the need for adjusting knife switches and field rheostats.



The New USL "Full Range" Welding Machine

Further advantages claimed for the new welder include: High striking voltage of 60 volts which is constant for all commercial sizes of electrodes—either bare or coated; the production of a welding arc which prevents burning on light work and assures deep penetration on heavy work; ease of operation and minimum possibility of freezing the electrode to the work. The Electrode Indicator is mounted on the forward end of the machine and is clearly visible at the left of the illustration. Directly above the hand-wheel there is a curved plate mounted on the housing. A small pointer moves back and forth across a scale engraved on this plate so that when the hand-wheel is turned the pointer shows for what size electrode the current has been adjusted.

PORTABLE SPOT WELDER WORKS IN ALL POSITIONS

The Almanc Portable Sheet Metal Spot Welder, manufactured and marketed by the Allan Mfg. & Welding Co., 726 Washington St., Buffalo, N. Y., has a unique gyroscopic mounting, or carrier, so that the welder can be readily shifted to any desired point of operation. The welding points can also be adjusted to any angle. By counter balancing one

The Almanc Portable Welder

operator can easily handle the welder. The welder is ruggedly constructed, and requires no artificial cooling; it is said to be economical in electric current consumption. It is constructed for any primary voltage and frequency. The Almanc Portable Spot Welder is particularly adapted as a handy tool in the shop or plant where sheet metal is fabricated, where its use will eliminate laying out, drilling, or punching, and riveting.

G. E. BULLETIN ON ELECTRIC BRAZING EQUIPMENT

General Electric Company Bulletin GEA-1311A, published by the General Electric Company, Schenectady, New York, describes electric equipment for brazing or hard soldering brass, copper, bronze and steel in repair or production work. This equipment operates on an electric resistance principle. The equipment itself and method of operation have been described in detail in several of the technical magazines during the past year.

NEW ELECTRODES HAVE NOVEL APPEARANCE

The Fusion Welding Corporation, Chicago, Ill., has recently announced a new type of mild steel electrode to be marketed under the trade name of "Ductone Fluxed", Ductone being the name applied to a special fluxing material which is used on these electrodes. Although at present this flux has been announced only for use with mild steel wires, it is suggested that the new flux may be applied to quite a variety of steels and possibly non-ferrous materials. It is stated that all Ductone fluxed rods will be decorated with metallic colors, the particular color in each case indicating the type of the rod, the flux itself being black. The mild steel Ductone fluxed eletrodes are decorated with silver applied on the bare end of the rod where it is gripped by the holder. It is claimed that this fluxing produces an extremely stable and smooth operating arc with practically no splashing of metal. Speed is said to be only a matter of the quantity of current available and the skill of the operator. Due to the peculiar operating characteristics of this new electrode, the manufacturers indicate that it is necessary to adopt a special technique when using them. This technique involves the use of a long arc with relatively high voltage and high amperage, using very little weaving, and holding the electrode approximately at right angles to the weld. Laboratory experiments have indicated high strength and ductility, welds in mild steel having been produced which show over 75,000 lbs. per square inch, tensile strength and elongation of over 40%.

LINCOLN SUPPLY CATALOG

A twenty-page catalog of arc welding supplies has just been published by the Lincoln Electric Company, Cleveland, Ohio. This catalog is in the 8x10 size and punched for binding. The first four pages are devoted to description and illustration of electrode materials for both metallic arc and carbon arc welding. In the section on electrode holders, four metal electrode holders and three carbon electrode holders are shown. Two pages are devoted to cables and cable accessories such as connectors and receptacles. Six types of hand shields and head shields are illustrated, together with a complete line of welding gloves and protective clothing. Although this catalog is intended primarily to give information regarding welding supplies, there are included illustrations and descriptions of four popular types of Lincoln stable arc welders.

NEW G. E. AUTOMATIC WELDER BULLETIN

The General Electric Company of Schenectady, New York, has just published Bulletin GEA-1351 which illustrates and describes their line of automatic arc welding equipment. This includes an automatic arc welder for tanks and pipe up to ten feet long and from five to forty-two inches in diameter, equipment for automatic arc welding of steel barrels, and a special self propeller for work on either battledeck floors or on the seams of large diameter pipe.

NEW STRAND CATALOG

N. A. Strand & Company, Manufacturers of Fexible Shafts and Equipments, 5001-5009 No. Lincoln St., Chicago, have published and now ready for distribution their new 56-page catalog illustrating and describing many new types and sizes of Fexible Shaft Machines.

CORRECTION

In the January issue of The Welding Engineer there were published photographs of a very interesting test head to be used in connection with welded pipe lines. This test head was designed by Mr. A. Dodge of the Construction Department of the Pacific Gas & Electric Company, and through an oversight this information was omitted when the article was prepared for publication.

LINDE EXHIBIT AT WESTERN METAL EXPOSITION

The Linde Air Products Company, 30 East 42nd Street, New York, N. Y., will occupy Booth C-9 at the National Western Metal and Machinery Exposition, San Francisco, California, February 16 to 20. The feature of the exhibit will be the testing of welded steel coupons with the Oxweld Portable Tensile Testing Machine. Specimens of 50,000-lb. tensile strength steel plate, welded with Oxweld No. 1 High Test and Oxweld No. 21 High Strength Bronze Welding Rods, will be tested. A complete line of Oxweld, Prest-O-Weld, and Purox equipment, which includes everything for oxwelding and cutting, and Prest-O-Lite Small Tank Appliances for heating and lighting will be exhibited. Specimens of Haynes Stellited machine tools will also be displayed.

NEW STRAIN GAUGE SHOWN AT A. S. C. E. MEETING

One of the most interesting features on the program of the annual meeting of the American Society of Civil Engineers, recently held in the Engineers' Society Building, 29 West 39th Street, New York City, was the demonstration of a magnetic strain gauge, in the course of development by the Westinghouse Electric and Manufacturing Company, by Brian Wheeler, a Westinghouse engineer. The demonstration was made in the Museum of Peaceful Arts, News Building, 220 East 42nd Street, New York City.

While the gauge is not available on the market, tests made by Westinghouse, particularly where changes of stress were at high rates of frequency, indicate it has potential value in scores of practical applications. Stresses have been recorded at the rate of 30 per second but this figure can be increased by speeding up the movement of the film of the oscillograph on which the curves are shown.

In construction, the Westinghouse gauge is about eight inches long with bolt holes in the two ends. The center section has two coils of wire which carry an electric current. A moving armature is adjustable within narrow limits and the slightest movement of this armature between the pole pieces changes the air gap across which the flux must pass from the two pole pieces to the ends of the armature.

Three wires carry the current through the gauge and either to the recording instrument or to the oscillograph where readings can be made or photographs taken as desired. The changes in the length of the air gaps upset the balance of the voltages across the gauge coils and indicates the degree of strain in the beam or rail at the point to which the gauge is attached.

AMERICAN WELDING SOCIETY JOURNAL APPEARS IN NEW FORM

Effective with the January, 1931 issue, the Journal of the American Welding Society makes its appearance in the 9x12" size which is becoming increasingly popular. This allows a type page size of 7x10". At the same time, a new typographical arrangement has been adopted. The January issue contains a splendid collection of technical papers and discussions of welding subjects together with a reproduction of the A. S. M. E. proposed specifications for fusion welding of unfired pressure vessels and a copy of the revised code for fusion welding and gas cutting in building construction which was formulated by the Committee on Building Codes in 1930.

USES FOR OXYGEN DISCUSSED AT C. G. M. A. MEETING

At the Eighteenth Annual Meeting of the Compressed Gas Manufacturers' Association, which was held at the Hotel Astor, New York City, on January 19th, there were two papers read at the technical sessions which were of special interest to manufacturers of oxygen. W. H. Ludington of the Air Reduction Sales Company read a paper called "Some Mechanical Applications of the Compressed Gas Industry" at the morning technical session. In this paper particular emphasis was placed on the growing use of mechanically operated oxy-acetylene cutting torches for cutting out parts of machines. In the afternoon technical session Dr. A. L. Barach of the College of Physicians and Surgeons, New York City, read a paper on "The Therapeutic Use of Oxygen," a subject which has become increasingly interesting to oxygen manufacturers during recent years.

The officers, elected for the ensuing year were: President, E. C. Turner, Air Reduction Co., New York City.

First Vice-President, J. A. Dixon, The Pintsch Compressing Co., New York City.

Second Vice-President, J. A. Kienle, The Mathieson Alkali Works, Inc., New York City.

Secretary-Treasurer, F. R. Fetherston, New York City.

NEWS OF THE INDUSTRY

A plant has recently opened in South Gate, Calif, which employs considerable welding in the manufacture of revolving tables used in a recently patented system of serving food in cafes, the food being conveyed from the kitchen to the dining counter by means of an endless belt carrier. Both electric and acetylene processes are used in the construction of these tables. A new General Electric welder was recently installed by the company.

Through The Superior Steel Corporation, the Steel Sales Corporation, Chicago, is prepared to offer Rustless 18-8 chrome nickel iron and Rustless 16-18 chrome iron in strip form for both mill and stock shipment. A 4-page bulletin has been prepared, describing and illustrating the many uses for these materials.

Carbo-Oxygen Company, Pittsburgh, Pa., announces the addition of a modern, completely-equipped, acetylene-producing plant to its manufacturing facilities at Caraopolis, Pa.

The new plant, costing approximately $100,000, will commence operations in the near future in the distribution of acetylene and related products to users in Pittsburgh and vicinity.

Ralph M. Ogan has recently been appointed superintendent of the Spartan Steel Co., of Compton, Calif., manufacturers of various kinds of oil tools and drilling equipment. Mr. Ogan was formerly foreman of the welding department of the company. As superintendent, he replaces Mr. E. M. Earlson. Mr. Ogan has had 15 years experience in welding, he having prior to his present connection, been associated with the Texas Company. Another important change in the management of this company is the recent appointment of Mr. E. Slama, as general manager.

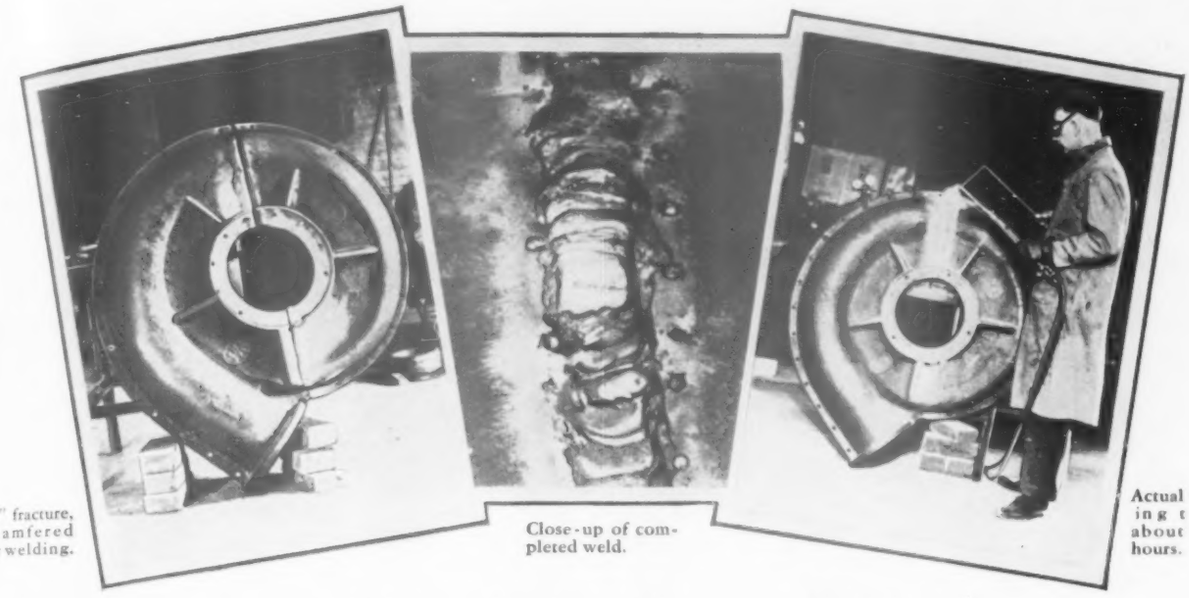
An outstanding achievement in the industrial world was made by the A. O. Smith Corporation of Milwaukee during 1930, when it shipped 472,000 tons of electrically welded pipe to all parts of the United States, compared with 425,000 tons in 1929.

A new welding shop has just opened for business at 162 West Main Street in Compton, California. Management consists of the partnership of J. R. Sims and A. H. Fisk, who formerly were located at 124 Long Beach Blvd., in Compton. General welding of all kinds, together with ornamental iron work, will be featured in the new location.

A series of blotters designed to show a new development in their welding service department has been prepared by the Meriam Co., 1955 West 112th St., Cleveland, Ohio. This department, which is now housed in the recently erected plant addition, comprises acetylene, atomic hydrogen and electric arc welding equipment, capable of dealing with a wide variety of difficult repair and construction work.

N. A. Strand & Company, 5001 No. Lincoln St., Chicago, have appointed Star Machinery Company, 1731-1741 First Ave., So., Seattle, Washington, as exclusive distributors in the State of Washington for their line of Flexible Shafts and Equipments. They will carry a full and complete stock.

Announcement has been made that effective January 1st Joseph T. Ryerson & Son, Inc., with main offices at Chicago acquired the lines of Maximillers, Production Millers and Automatic Indexing Machines heretofore produced by Kempsmith Manufacturing Company of Milwaukee. The transfer involves an outright purchase of good will, patterns, inventory and other assets pertaining to these lines. The Cone Drive Milling Machines produced by the Kempsmith Company are not involved in the transaction.



26" fracture, chamfered for welding.

Close-up of completed weld.

Actual welding time, about three hours.

Repair Welded *with* TOBIN BRONZE

to prevent warpage or internal strains

A CENTRIFUGAL pump housing weighing 350 lbs. became fractured across the surface. To replace a casting of this size would have entailed an expense many times greater than the cost of repair.

Tobin Bronze Welding was used in preference to ferrous welding in order to eliminate possibility of warpage or internal strains. For with Tobin Bronze it is necessary to heat the surfaces of weld areas to a dull red only. This mild heat does not expand the metal sufficiently to cause warping or subsequent cracking.

Publication B-13, containing full information on all Anaconda Welding Rods, will be sent free on request.

* * *

Anaconda Welding Rods are available through leading distributors of welding equipment and supplies. For those requiring small quantities, Anaconda Welding Rods can now be obtained in clearly labelled ten-pound packages.

There is a suitable Anaconda Filler Rod for every bronze-welding purpose. Principal Anaconda Welding Rods, with their melting points, are listed below:

for oxy-acetylene welding

Tobin Bronze*	1625°F
Manganese Bronze	1598°F
Brazing Metal	1634°F
Naval Bronze	1625°F
Electrolytic Copper	1981°F
Silicon Copper	1981°F
Phosphor Bronze	1922°F
Everdur*	1866°F

for arc welding

Silicon Copper	1981°F
Phosphor Bronze	1922°F
Everdur*	1866°F

*Reg. U. S. Pat. Off.

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from mine to consumer

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Offices and Agencies in Principal Cities

ANACONDA WELDING RODS

C. E. Phillips & Co., representing the Stoody Company, Whittier, Calif., have announced the removal of their Chicago office and warehouse to 1929 W. 43rd St., Chicago (Phone, Virginia 1010), where a complete line of Stoody Products will be carried.

The L. E. Myers Co. has been awarded a further contract by Will Cook Construction Company for the laying of 33 miles of 24-inch gas main between Rockdale and Lyons, Illinois, constituting another artery of the 1,000-mile natural gas pipe-line which will run from the Texas fields to the Chicago district.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Count 8 words to line. Add 6 words for keyed address.

FOR SALE

For Sale—Oxygen Plant complete. Liquid Air Process. Capacity 15 M 3 Oxygen per hour. Purity 99% to 99.5%. A-No. 1 condition. Address 403, c/o The Welding Engineer.

Welding Shop and Supply Business—Well established. Nets $15,000 per year. Gas and Electric Equipment. Three thousand dollars to handle. Address Box 404, c/o The Welding Engineer.

POSITIONS WANTED

Position Wanted—First-class welder experienced in both arc welding and oxy-acetylene welding wants position in contract shop. Can furnish excellent references and in last connection worked for same firm four years. Address J. E. Simpson, 407 Fir Street, Plainview, Texas.

Salesman—Seven years' experience oxy-acetylene line, sales and service, desires connection with national manufacturer. Address 401 c/o The Welding Engineer.

Position Wanted—20 years experience in structural steel estimating, erecting and welding bridges, buildings and pipe lines. Electric and acetylene. Address 402 c/o The Welding Engineer.

Job Wanted by welder. Can furnish 375-amp. gas-driven Lincoln or 300-amp. Una welder; both practically new. Am steady, sober, 28 years old, and can give reliable references. Will go anywhere on contract. Write Tom Poats, P. O. Box 142, Wyandotte, Mich.

Electric and Gas Welder, 11 years' experience, job welding and tank. Write Robert Morrow, 24 W. Huron St., Chicago, Ill.

Job Wanted—Welder, mechanic, salesman, seeks opportunity. Experienced aircraft, pipe line, job shop and instructor. American ex-service man, age 33. What can you offer? Hugh Ridlon, Strand Hotel, Boston, Mass.

Experienced Acetylene Welder desires position, preferably in airplane factory, but will take any work. Thoroughly capable, and can furnish the best of references. Address Box 302, The Welding Engineer.

Electric and Acetylene Welder, with 18 years' experience in all classes of work, including tanks, high-pressure boilers, pipe lines, cast iron, brazing, sheet-metal work, auto bodies, drum shops, airplanes, and just completed a two-year job on a refinery project. Write John B. Davis, General Delivery, Syracuse, N. Y.

Young Experienced Welder, both acetylene and electric, wishes permanent job. Will go anywhere. Write Bernard Rueter, 365 Perkins Blvd., Burlington, Wis.

Resistance Welding Engineer desires position with firm wishing to improve assembly methods. Thoroughly experienced producer. Address Box 303, The Welding Engineer.

Job Wanted—By first class electric and acetylene welder, 13 years experience, seven in job shops. Very good auto radiator repairman and fair body and fender worker. Address Russell Dickerson, P. O. Box 172, Roxana, Ill.

UNDER-WATER METAL CUTTING CORPORATION
Complete apparatus and skilled diver operators for cutting steel plate, sheet piling, cast iron or any metal under water.
c/o MERRITT-CHAPMAN & SCOTT
17 Battery Place - New York, N. Y.

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REBUILT ELECTRIC ARC WELDERS
SERVICE COMPANY
3741 Cedar Ave. Cleveland, Ohio

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Business is on the turn. The demand for competent men will soon be setting in. When your turn comes, here's the means to find the man you want.
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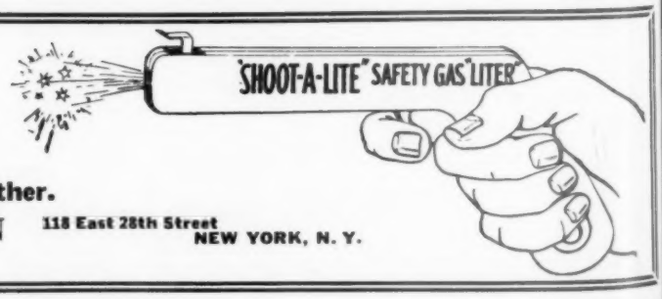
45 East 17th Street New York City
Should your requirements be for professional engineers or technicians, write:
Walter V. Brown, Engineering Societies Building, 31 West 39th Street, New York City
This work is the free contribution of these professional organizations to industry.

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